Including Ham Radio Fun!

SEPTEMBER 1997
ISSUE #444
USA $3.95
CANADA $4.95

International Edition

73® Amateur Radio Today

Build an ATV Transmitter

ABCs of HF Antennas

ABCs of Modems

Reviews:
MFJ-969 300W Ant. Tuner (Wow!)
Ten-Tec 1340 QRP Xcvr

75th Birthday

**************************5-DIGIT 48103
#0000191960WRS# JUN76
SERIALS PROCESSING DEPT
UNIV MICROFILMS IT
300 N ZEEB RD
ANN ARBOR MI 48103-1553

Finally – A Professional-Quality Receiver to Monitor Weather Broadcasts!

NEW **Our new RWX is a very sensitive and selective Hamtronics® grade receiver to monitor critical NOAA weather broadcasts.**

Excellent 0.15µV sensitivity provides good reception even at distances of 70 miles or more with suitable antenna. No comparison with ordinary consumer radios!

Automatic mode provides storm watch, alerting you by unmuting receiver and providing an output to trip remote equipment when an alert tone is broadcast.

Essential for airports, police and fire departments, CAP, broadcast stations, state and local emergency managers, amateur repeaters – anyone needing a professional quality receiver. Because of its reasonable price, it is also handy for bikers, hikers, boaters, hunters, farmers – or anyone who needs up-to-date weather info and emergency warnings, even from distant stations.

Small enough for emergency or portable use, it can even be powered from a small 9-12V battery when needed. Crystal controlled for accuracy; **all 7 channels provided** (162.40 to 162.55).

You can buy just the receiver pcb module in kit form or buy the kit with an attractive metal cabinet, AC power adapter, and built-in speaker. It is also available factory wired and tested.

- RWX Rcvr kit, PCB only $79
- RWX Rcvr kit with cabinet, speaker, & AC adapter $99
- RWX Rcvr wired/tested in cabinet with speaker & adapter.....$139

WWV RECEIVER

NEW Get time and frequency checks without buying multiband hf rcvr. Hear solar activity reports affecting radio propagation. Very sensitive and selective crystal controlled superhet, dedicated to listening to WWV on 10.000 MHz. Performance rivals the most expensive receivers.

- **RWWV Rcvr** kit, PCB only $59
- **RWWV Rcvr** kit with cabt, spkr, & 12Vdc adapter $89
- **RWWV Rcvr** w/t in cabt with spkr & adapter $129

WEATHER FAX RECEIVER

Join the fun. Get striking images directly from the weather satellites! A very sensitive wideband fm receiver **optimized for reception of NOAA APT and Russian Meteor weather fax** images on the 137 MHz band.

The R139 is lower cost and easier to maintain than synthesized units. And it is designed from the ground up for optimum satellite reception; not just an off-the-shelf scanner with a shorted-out IF filter!

Covers all five satellite channels. Scanner circuit and recorder control allow you to automatically search for and tape signals as satellites pass overhead, even while away from home.

- **R139 Receiver Kit** less case $159
- **R139 Receiver Kit** with case and AC power adapter..................$189
- **R139 Receiver w/t** in case with AC power adapter.......................$239
- Internal PC Demodulator Board and Imaging Software $289
- Turnstile Antenna $119
- Weather Satellite Handbook $20

SUBAUDIBLE TONE ENCODER/DECODER

NEW **Access all your favorite closed repeaters with TD-5 CTCSS Encoder/Decoder**

Encodes all standard subaudible tones with crystal accuracy and convenient DIP switch selection. Comprehensive manual also shows how you can set up a front panel switch to select between tones for several repeaters. Receiver **decoder** can be used to mute receive audio and is optimized for installation in repeaters to provide closed access. High pass filter gets rid of annoying buzz in receiver.

- **TD-5** CTCSS Encoder/Decoder Kit .... only **$39**
- **TD-5** CTCSS Encoder/Decoder Wired/tested **$59**

HIGH QUALITY VHF & UHF FM XMTR AND RCVR MODULES

FM EXCITERS: 2W output, continuous duty.

- **TA51:** for 6M, 2M, 220 MHz .. **kit $99, w/t $169.**
- **TA451:** for 420-475 MHz. .... **kit $99, w/t $169.**
- **TA901:** for 902-928 MHz, (0.5W **out**).......**w/t $169.**

VHF & UHF POWER AMPLIFIERS.
Output levels from 10W to 100W **Starting at $99.**

FM RECEIVERS:

- **R100 VHF FM RECEIVERS** Very sensitive – 0.15µV. Superb selectivity – both crystal and ceramic IF filters, >100 dB down at ±12kHz, best available anywhere, flutter-proof squelch. For 46-54, 72-76, 140-175, or 216-225 MHz. .... **kit $129, w/t $189**
- **R144/R220 RCVRS.** Like R100, for 2M or 220 MHz, with helical resonator in front end.....**kit $159, w/t $219**
- **R451 FM RCVR**, for 420-475 MHz. Similar to R100 above. ....**kit $129, w/t $189**
- **R901 FM RCVR**, 902-928MHz ....**$159, w/t $219**

TRANSMITTING AND RECEIVING CONVERTERS

Go on a ham satellite adventure! Add another band for the next contest. Thrill in the excitement of building your own gear, and save a bundle.

No need to spend thousands on new transceivers for each band!

- Convert vhf and uhf signals to/from 10M.
- Even if you don't have a 10M rig, you can pick up very good used xmtrs & rcvrs for next to nothing.
- Receiving converters (shown above) available for various segments of 6M, 2M, 220, and 432 MHz.
- Kits from $49, wired/tested units only $99.
- Xmitting converters (at left) for 2M, 432 MHz.
- Kits only $89 vhf or $99 uhf.
- Power amplifiers up to 50W output.

Get more features for your dollar with our

REP-200 REPEATER

A microprocessor-controlled repeater with full autopatch and many versatile dtmf control features at less than you might pay for a bare-bones repeater or controller alone!

- ***kit still only $1095***
- ***factory assembled still only $1295***

50-54, 143-174, 213-233, 420-475 MHz. (902-928 MHz slightly higher.)
FCC type accepted for commercial service in 150 & 450 MHz bands.

Digital Voice Recorder Option. Allows message up to 20 sec. to be remotely recorded off the air. Play back at user request by DTMF command, or as a periodical voice id, or both. **Great for making club announcements!** .... only $100.

REP-200C Economy Repeater. Real-voice ID, no dtmf or autopatch. .... Kit only $795, w&t $1195.

REP-200N Repeater. Without controller so you can use your own. .... Kit only $695, w&t $995.

You'll KICK Yourself
If You Build a Repeater
Without Checking Out Our Catalog First!

Hamtronics has the world's most complete line of modules for making repeaters. In addition to exciters, pa's, and receivers, we offer the following controllers.

COR-3. Inexpensive, flexible COR module with timers, courtesy beep, audio mixer. ....**only $49/kit, $79 w/t**

CWID. Traditional diode matrix ID'er. ....**kit only $59**

CWID-2. Eprom-controlled ID'er. ..**only $54/kit, $79 w/t**

DVR-1. Record your own voice up to 20 sec. For voice id or playing club announcements. ...... **$59/kit, $99 w/t**

COR-4. Complete COR and CWID all on one board. ID in eprom. Low power CMOS. ......**only $99/kit, $149 w/t**

COR-6. COR with real-voice id. Low power CMOS, non-volatile memory. .... **kit only $99, w/t only $149**

COR-5. µP controller with autopatch, reverse ap, phone remote control, lots of DTMF control functions, all on one board, as used in REP-200 Repeater. .... **$379 w/t**

AP-3. Repeater autopatch, reverse autopatch, phone line remote control. Use with TD-2. .... **kit $89**

TD-2. Four-digit DTMF decoder/controller. Five latching on-off functions, toll call restrictor. .... **kit $79**

TD-4. DTMF controller as above except one on-off function and no toll call restrictor. Can also use for selective calling; mute speaker until someone pages you... **kit $49**

LOW NOISE RECEIVER PREAMPS

LNG-( ) G_AA_S FET PREAMPS
STILL ONLY $59!

- Make your friends sick with envy! Work stations they don't even know are there.
- Install one at the antenna and overcome coax losses.
- *Available for 28-30, 46-56, 137-152, 152-172, 210-230, 400-470, and 800-960 MHz bands.*

LNW-( ) ECONOMY PREAMPS
ONLY $29 kit, $44 wired/tested

- Miniature MOSFET Preamp
- Solder terminals allow easy connection inside radios.
- *Available for 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, and 400-500 MHz bands.*

- Buy at low, factory-direct net prices and save!
- For complete info, call or write for free catalog.
- Order by mail, fax, or phone (9-12 AM, 1-5 PM eastern time).
- Min. $5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, Discover, check, or UPS C.O.D.

View Catalog on our Web site:
www.hamtronics.com
e-mail: jv@hamtronics.com

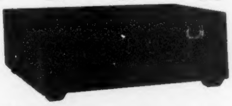
hamtronics, inc.
65-D Moul Rd; Hilton NY 14468-9535
Phone 716-392-9430 (fax 9420)

ASTRON CORPORATION

9 Autry
Irvine, CA 92718
(714) 458-7277 • FAX (714) 458-0826
www.astroncorp.com

SWITCHING POWER SUPPLIES

	CONT.	ICS	WT.(LBS)
SS-10	7	10	3.2
SS-12	10	12	3.4
SS-18	15	18	3.6
SS-25	20	25	4.2
SS-30	25	30	5.0



SS-25M With volt & amp meters
SS-30M With volt & amp meters

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

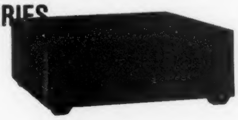
SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES



- LOW PROFILE POWER SUPPLY

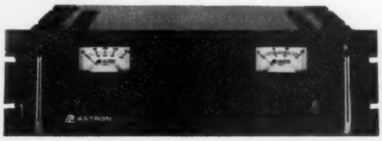
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
SL-11A	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R	•	•	7	11	2⅝ × 7 × 9¾	12
SL-11S	•	•	7	11	2⅝ × 7⅝ × 9¾	12
SL-11R-RA		•	7	11	4¾ × 7 × 9¾	13

RS-L SERIES

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-4L	3	4	3½ × 6⅛ × 7¼	6
RS-5L	4	5	3½ × 6⅛ × 7¼	7

RM SERIES



MODEL RM-35M

- 19" RACK MOUNT POWER SUPPLIES

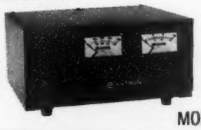
MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46
RS-70A	•		57	70	6 × 13¾ × 12⅛	48

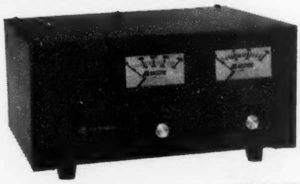
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46
RS-70M	57	70	6 × 13¾ × 12⅛	48

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	Continuous Duty (Amps) @10VDC	Continuous Duty (Amps) @5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
VS-70M	67	34	16	70	6 x 13¾ x 12⅛	48
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

- Built in speaker

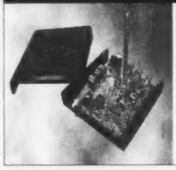
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18
SL-11S	•	•	7	11	2¾ x 7⅝ x 9¾	12

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

RAMSEY ELECTRONIC HOBBY & AMATEUR RADIO KITS

Synthesized FM Stereo Transmitter



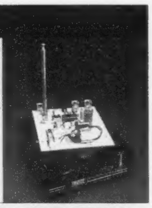
Microprocessor controlled for easy frequency programming using DIP switches, no drift, your signal is rock solid all the time. Audio quality is excellent, connect to the line output of any CD player, tape deck or mike mixer and you're on-the-air. Foreign buyers will appreciate the high power output capability. New, improved, clean and hum-free runs on either 12 VDC or 120 VAC. Kit comes complete with case, whip antenna, 120 VAC power adapter -easy one evening assembly.

FM-25 Synthesized FM Stereo Transmitter Kit..........................129.95

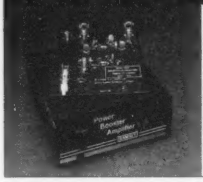
Tunable FM Stereo Transmitter

A lower cost alternative to our high performance transmitters. Tunable over the 88-108 MHz FM broadcast band, plenty of power and our manual goes into great detail outlining aspects of antennas, transmitting range and the FCC rules and regulations. Connects to any cassette deck, CD player or mixer. You'll be amazed at the exceptional audio quality! Runs on internal 9V battery or external power from 5 to 15 VDC, or optional 120 VAC adapter.

FMAC 120 VAC adapter..$ 9.95
FM-10A Tunable Fm Stereo Transmitter...$34.95
CFM Case Set for FM-10A...$14.95



RF Power Booster Amplifier



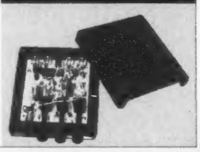
Add some serious muscle to your signal, boost power up to 1 watt over a frequency range of 100 Khz to over 1000MHz! Use as a lab amp for signal generators, plus many foreign users employ LPA-1 to boost the power of their FM Stereo transmitters, providing radios service through an entire town. Power required: 12 to 15 volts DC at 250mA, gain of 38dB at 10MHz, 10dBat 1000MHz.

LPA-1RF Power Boost Amplifier Kit..................................$39.95
CLPA Case for Linear Power Booster Amplifier................$14.95

Stereo Transmitter Companion

Connects easily between your CD player, mike mixer (our MX-5 or 10 is ideal) or tape deck and the FM10A, FM25 or AM1 radio transmitter. Tunes come alive with the bass and brilliance or bass and presence controls. Low cost CD players with poor filtering on the output are cleaned up by the switched-capacitor low pass filtering in the STC1. Higher order harmonics and clock feed-through what causes annoying heterodynes and whooshing noises. Operates on 9 to 15 volts DC. Available fully wired and tested.

STC-1 Kit Stereo Transmitter Companion Kit.................$59.95
CSTC Matching Case..$14.95
STC-1WT Fully Wired and Tested w/Case........................$99.95

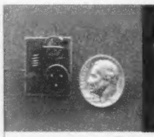


Crystal Controlled Wireless Mike

Super stable, drift free, not affected by temp, metal or your body! Frequency is set by a crystal in the 2 meter Ham band of 146.535 MHz, easily picked up on any scanner radio or 2 meter rig. Changing the crystal to put frequency anywhere in the 140 to 160 MHz range-crystal cost only $5-6. Sensitive electric condenser mike picks up whispers anywhere and transmit up to 1/4 mile. Powered by 3 volt Lithium or pair of watch batteries which are included. Uses the latest in SMT surface mount parts and we even include a few extras in case you loose a part!

FM-6 Wireless Mike Kit..........................$39.95

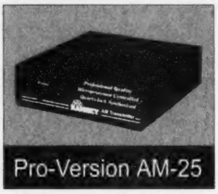
Micro Wireless Mike Kit



World's smallest FM transmitter. Size of a sugar cube! Uses SMT (Surface Mount Technology) devices and mini electret condenser microphone, even the battery is included. We give you two complete sets of SMT parts to allow for any errors or mishaps -build it carefully and you've got extra SMT parts to build another! Audio quality and pick-up is unbelievable, transmission range up to 300 feet, tunable to anywhere in standard FM band 88 to 108 MHz. 7/8"w x 3/8"h x 3/4"d.

FM-5 Micro Wireless Mike Kit...............$19.95

AM Radio Transmitters



Pro-Version AM-25

Entry-Level AM-1

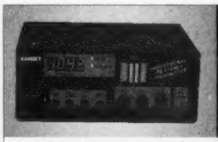
Learn how commercial radio transmitters work and broadcast your own AM radio station. Our AM-25 pro-version, fully synthesized transmitter features easy frequency setting DIP switches for sable, no-drift frequency control, while being jumper settable for higher power output where regulations allow. It comes complete with AC power adapter, matching case and bottom loaded wire antenna.

AM25 Professional Kit............$129.95

Broadcast your own AM radio station. The entry-level AM-1 uses a tunable transmit oscillator and runs the maximum 100 milliwatts of power. No FCC license is required, expected rang is up to 1/4 mile depending upon antenna and conditions. Transmitter accept standard line-level inputs from tape decks, CD players or mike mixers, and run on 12 volts DC.

AM-1 AM RadioTransmitter................$29.95
CAM Matching Case..........................$14.95
AC12-5 VDC wall plug adapter.........$ 9.95

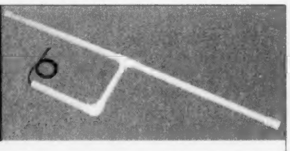
Super Pro FM Stereo Radio Transmitter



A truly professional frequency synthesized FM stereo transmitter station in one easy to use handsome cabinet. Most radio stations require a whole equipment rack to hold all the features we've packed into the FM-100. Set frequency easily with the Up/Down freq. buttons and the big LED digital display. Plus there's input low pass filtering that gives great sound no matter what the source (no more squeals or swishing sounds from cheap CD player inputs!) Peak limiters for maximum 'punch' in your audio-without over modulation, LED bargraph meters for easy inputs. No one offers all these features at this price! Kit includes sharp looking metal cabinet, whip antenna and 120 volt AC adapter. Also runs on 12 volts DC.

FM-100 Super Pro FM Stereo Radio Transmitter Kit...$299.95

Tru-Match FM Broadcast Antenna



The true match antenna really is a true match to your transmitter, getting the maximum range. It is an electrical impedance match..If the proper impedances are not maintained between transmitter and antenna, power is reflected back away from the antenna and back into the transmitter and back into the transmitter, causing the final amplifier stage to be damaged! Our antenna kit consists of rugged precut PVC pipe, antenna radiating elements and of course the proper matching assembly and is fully water resistant when assembled. It is easily mounted to any standard TV antenna mast like you can find at Radio Shack or K-Mart. A standard 'F' style coax connector issued, so that readily available, low cost RG-59 TV coaxial cable can be used for connection. We even supply and RCA phone to F Male adapter for easy connection to any transmitter antenna jack. Total length is about five feet, and it is easily mounted horizontally or vertically polarized, and we even explain in the manual the pluses and minuses for each. Maximum input power is ONE watt.

TM-100 Tru-Match FM Broadcast Antenna Kit..$39.95

RAMSEY ELECTRONICS
BEST KIT BUILDERS IN THE WORLD

RAMSEY ELECTRONICS, INC.
793 Canning Parkway Victor, NY 14564 (716)924-4560 FAX 716-924-4555

ORDER LINE 1-800-446-2295 CALL FOR A FREE CATALOG!

ORDERING INFORMATION:
Satisfaction Guaranteed. Examine for 10 days, if not pleased, return in original form for refund. Add $5.95 for shipping, handling and insurance. Orders under $20, add $3.00. NY residents add 7% sales tax. Sorry, no COD's. Foreign orders, add 20% for surface mail or use credit card and specify shipping method.

SEPTEMBER 1997
ISSUE #444

Including Ham Radio Fun!

73® Amateur Radio Today

TABLE OF CONTENTS

THE TEAM

El Supremo & Founder
Wayne Green W2NSD/1

Associate Publisher
F. I. Marion

Associate Technical Editor
Larry Antonuk WB9RRT

Nitty Gritty Stuff
J. Clayton Burnett
Priscilla Gauvin
Joyce Sawtelle

Contributing Culprits
Bill Brown WB8ELK
Mike Bryce WB8VGE
Joseph E. Carr K4IPV
Michael Geier KB1UM
Jim Gray W1XU/7
Jack Heller KB7NO
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister W5ACM
Dave Miller NZ9E
Joe Moell K0OV
Steve Nowak KE8YN/5
Carole Perry WB2MGP

Advertising Sales
Frances Hyvarinen
Roger Smith
603-924-0058
800-274-7373
Fax: 603-924-8613

Circulation
Linda Coughlan

Data Entry & Other Stuff
Christine Aubert
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA by
Quad Graphics

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made upon publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens must include their Social Security number with submitted manuscripts so we can submit it to you know who.

FEATURES

9 **Video Transmitter — KC5AWJ**
Delta — the ATV transmitter you can change to fit your needs. Three bands, one design.

20 **Explorers, Adventurers, and Experts — KB9FO**
How would you rule on this?

30 **The New Emergency Alert System — WD8DAS**
Don't tune out that emergency broadcast test just because the Cold War's over!

32 **Holiday of a Lifetime — G3LDI**
Ham friends are lifelong friends — even if you're meeting them for the first time!

REVIEWS

37 **Inside MFJ's New 969 — N0BLX**
The Versa Tuner II could be for you.

41 **Secrets of the 1340 — WB8VGE**
Inside Ten-Tec's new QRP transceiver kit.

HAM RADIO FUN SECTION

64 **Communications Simplified, Part 21 — K2OAW**

71 **Oscillator Circuits — W6WTU**
Part two in a series of three.

74 **The ABCs of HF Antennas — NZ9E**
Beginning hams, take heart!

DEPARTMENTS

WB6IGP	82	Above & Beyond
	73	Ad Index
KB1UM	51	Ask Kaboom
	46	Barter 'n' Buy
K4IPV	50	Carr's Corner
KB7NO	56	The Digital Port
WB2MGP	61	Hams With Class
W5ACM	60	Hamsats
NZ9E	54	Ham to Ham
K0OV	84	Homing In
	6	Letters
W2NSD/1	4	Never Say Die
	39	New Products
KE8YN/5	58	On the Go
W1XU	87	Propagation
WB8VGE	52	QRP
	8	QRX
	46, 50, 51 58, 62 ,88	Radio Bookshop
WA3AJR	59	RTTY Loop
	44	Special Events

On the cover: Yue-Er Lian KB5JNY, antenna tuner technician (left), and Martin F. Jue K5FLU, president and founder of MFJ Enterprises, Inc., examine a new MFJ-949E antenna tuner. The MFJ-949E covers 1.8–30 MHz and handles 300 watts. Congratulations to MFJ who will celebrate their 25-year anniversary next month.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1997 by 73 Magazine. No part of this publication may be reproduced without written permission of the publisher, which is not all that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

NEVER SAY DIE

Wayne Green W2NSD/1

Happy Birthday *73*!

Next month we'll be starting our 38th year! It's been a fun and exciting 37 years. Wow, the adventures I've had as a result of amateur radio! Which is why I keep being such a pest, trying to get you off the couch and enjoying the fun that's out there, if only you'll make the effort. The slow-scan guys are having so much fun, it would be made illegal if the government suspected. The packet guys need some goosing if they're going to keep up with the Internet. So get in there and goose 'em. Let's see some blindingly-fast HF packet developed. They're putting video and hi-fi audio on the Web, so how long is it going to take you to catch up?

Medical Update

A couple years or so ago I explained about the Australian doctor who had discovered that peptic ulcers are caused by bacteria, not stress. *Helicobactor Pylori*. Dr. Barry Marshall fought the medical establishment for 10 years before he made any headway in getting what he'd discovered recognized. I think it was an article in *The New Yorker* that finally broke the establishment's resistance.

The June 9th issue of *Fortune* had a seven-page article on the subject. It points out that even today, 13 years after Marshall made his discovery, most doctors are still treating ulcers the same old way, mainly with Zantac™ and Tagamet™, which enjoy over $5 billion in sales per year. Tagamet™ is the best-selling drug on earth. However, as usual, these drugs treat the symptoms, not the infection, so when a patient stops taking them he's right back to the doctor for a new prescription. It's a great moneymaker for the industry, with ulcer patients making up about 25% of most practices. And now and then the doctor does an endoscopy, for which he charges $1,000, so he can take a look-see in the stomach. 10% of Americans have ulcers, and it's almost 100% in some countries.

Perhaps you can understand why the medical industry has been so amazingly resistant to curing ulcers, which have been considered an annuity disease by doctors.

This may also help you understand why the Albert Einstein College of Medicine is keeping their simple electronic cure for AIDS, herpes, lupus, Lyme Disease, syphilis, etc., quiet. I'm hoping that I can get the word out enough about the Bioelectrifier so that it can't be stopped. But now perhaps you can understand why the industry has less than zero interest in testing the unit or in getting it accepted by the FDA.

The FDA, by the way, has no interest at all in whether something cures an illness or not; they are in business to enforce the laws which say that only drugs and procedures which have been accepted by the FDA are permitted to be used. If you have the slightest doubt about this you need to read some of the books in my guide. Read about Royal Raymond Rife, Gaston Naessens, Wilhelm Reich, and a bunch of other doctors who were persecuted, and often imprisoned.

Go to the library and read the *Fortune* article and see if you don't get a little angry. If you have any kind of an illness you need to do some homework and not put your life blindly in the hands of your doctor, depending totally on his expertise and honesty. Indeed, as a result of my radio interviews I've gotten letters from a distressing number of doctors the FDA has put in prison for using non-FDA-accepted procedures.

By the way, the *Fortune* article points out that most doctors don't bother to read the medical magazines or go to conferences. They depend mostly on the salesmen from the drug companies for their information on what's new.

I've mentioned in a recent editorial about the TV exposé on the cure for epilepsy which was discovered at the Johns Hopkins Hospital several years ago and then kept quiet. And Dr. Wallach says in his book that diabetes can easily be cured, and he explains how.

Our Oblate Spheroid

Along about in the second grade my geography teacher, Miss Camel, explained that the world is not a sphere, but an oblate spheroid. Naturally, I believed her. Now comes known troublemaker René, who says that's baloney. Of course, when I pointed out to Miss Camel that the coasts of Africa and South America were remarkably similar, making it look as if they must have been connected sometime, she said that was just a coincidence.

René was struck by the anomaly of the remains of thousands of tropical animals being found in the Arctic. You see, even if the Earth were warm enough for them to live there, there would not be enough sunlight all year around for the trees these animals needed for food to grow. This suggests that either the Earth's crust or the Earth itself shifted. Well, something had to shift, and very suddenly, too.

René points out that no matter how carefully we map the Earth the adjacent maps don't quite fit. He suggests that if the Earth were a sphere and had no equatorial bulge, the maps would then fit. So he's interested in getting together with someone to measure the angles of the stars rising from the horizon to pin down how much bulge, if any, there really is.

Scientists have no good explanation for the huge piles of animal bones in some places in the Arctic which testify to a sudden mass extinction. Nor for mammoths frozen in the ice, some still standing, with tropical plants in their stomachs. So maybe there's something to the idea that the Earth may be a sphere and occasionally change its axis. Velikovsky may not have been that far off. And, who knows? Atlantis may be buried under a couple miles of ice at what is now the South Pole.

René made a very good case for our being flim-flammed on the Moon landings (no one who has read his *NASA Mooned America* book has refuted his arguments). Ditto his scientific blasphemy in his *The Last Skeptic of Science*.

René is also exercised over the Fed and our money supply. But that's a mess you really don't want to know about. That might get even you upset, and we sure don't want *that*.

René suggests that the off-center buildup of ice at the poles could cause the Earth to suddenly change its axis, causing warmer regions to move to the new poles. Robert Felix, in his book, *Not By Fire, But By Ice*, points out that ice cores in Greenland show that ice buildups happened in days, not eons, and that they are consistent with the magnetic pole reversals.

Just think what a sudden shift of the Earth's magnetic field might do to every data tape or disk in the world! A magnetic pulse of one gauss sweeping through all magnetic media might well destroy our data disks, including our hard drives. No, it wouldn't bother CD-ROMs.

So René may be right in his *Skeptic* book after all when he says there never has been an ice age, only a shifting of the poles.

A fast change in the Earth's poles would not only flash-freeze previously warm regions, as has happened before, but would undoubtedly trigger enormous worldwide floods. Like the one Noah did so well with—and is also reported in virtually every ancient record we have.

Pole shifts like this have apparently happened frequently in geologic history and another is due any day now, so keep your seat belts fastened when you drive, and it wouldn't hurt to keep a parka and some scuba gear handy.

Basics

In my editorial a few months ago I asked for recommendations of any currently available books on the fundamentals of electricity. A note from Mark WX3O suggests you encourage newcomers to the hobby to get *Getting Started in Electronics* by Forrest Mims, which is available for $6 from Radio Shack™. Bargain. Mark says he's been using it with home-schoolers for seven years with excellent results. He also recommends the "First Steps in Electronics" kit.

Antiques

An article by Ed Mitchell KF7VY in the SJRA *Harmonics* almost got me to thinking. It had to do with the decline of amateur radio, citing our lack of license growth and the ARRL's deficit last year.

He pointed out that CW is 100 years old, SSB is 40 years old, and NBFM is 50 years old. SSTV is also about 40 years old and our packet protocols are still hung up in the computer dark ages. He feels the FCC restrictions on our experimenting and pioneering are the main problem. Well, they're certainly a big problem, but the lack of incoming youngsters is even more serious, I feel. All of our major breakthroughs in the past have been done by youngsters. I was 25 in 1948 when I helped pioneer NBFM by building a reactance modulator into my BC-459 exciter. I was 36 in 1959 when I flew around the world operating SSB from a plane.

The FCC's restrictions on experimenting have long been a complaint of mine. When I got involved with RTTY in 1949 (almost 50 years ago) we were restricted to 2m and up (plus 11m). It was a long fight to get them to allow RTTY on the HF bands, with the ARRL fighting every inch of the way to prevent it, but we finally made it. Even so, we had to send our calls using CW so the FCC monitoring stations, which could not copy RTTY, could identify us.

We should be free to experiment with high speed ASCII, spread spectrum, and anything else we want to develop. We need to break loose from the federal straightjacket. One of the charter reasons for the amateur "service" is its mandate to experiment and pioneer new technologies, so why has the FCC so consistently hobbled us over the 46 years I've been dealing with them?

Instead of pushing to pioneer new technologies, we're all embroiled over preserving the oldest and slowest mode of electronic communications—CW. Well, it'll make an interesting story in the history books. Despite bitter opposition we did manage to get rid of spark. And we've almost gotten rid of AM. But CW Forever, right?

Webbing It

The Web is turning out to be what I'd hoped we could develop with ham satellites: a way for anyone anywhere to get in touch with anyone else. Anyway, if you're interested in checking into a Bioelectrifier page you can find Miller at [www.infocom.com/~thomil/], and Far Circuits at: [cl.ais.net/farcir/], with the usual [http://www.] lead-in. Yes, I know, I should have a Web page too. If I had one I wouldn't have time to service it, so get off my back. If you have any other Web sites we should all know about, let me know. With some significant encouragement we'll run a regular listing of Web sites which could interest you.

The FDA

In a recent interview on the Art Bell (W6OBB) show I was discussing the ways in which we poison our bodies, thus weakening our immune systems and making us more prone to both chronic and transient sicknesses. When I mentioned the mercury poisoning that results from dental amalgam used in filling teeth, Art protested that his dentist, in whom he had faith, said that was all a bunch of baloney. Ditto my pointing out the poisons teeth with root canals pour into our bodies. My credibility was at a low point with Art.

Then a couple of dentists called in and backed me up, citing the credentials and work done by Dr. Meinig, who wrote *Root Canal Cover-up*. I've reviewed his book in my editorial and it's in my guide to "books you're crazy if you don't read." Ditto Dr. Huggins' book on amalgam, *It's All In Your Head*. 98% of people with multiple sclerosis have mercury poisoning.

Yes, the ADA is doing it's best to discredit these two pioneers. You can tell a pioneer by the arrows in his back in any field. In the cold fusion field the ridicule and humiliation is continuing, despite the recent NASA research report totally confirming the cold fusion phenomenon.

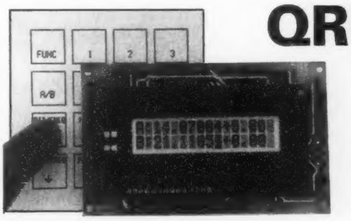
A recent book by Elaine Feuer, *Innocent Casualties*, Dorrance Publishing, 1996, $15, 174pp, ISBN 0-8059-3819-2, is a harrowing exposé of the FDA's war against any non-drug alternatives for curing AIDS. The FDA, though provided with solid proof that True Health had a dietary cure for AIDS, crushed the company. It wasn't patentable, so the drug cartel couldn't make billions of dollars.

With each accepted new drug providing an average of $231 million to feed the tens of thousands of FDA employees and administrators, and taking an average of 10 years to be accepted, any inexpensive cure for anything is fought with every weapon at their disposal, and they have their own SWAT teams.

Get the Book

Then, if you still think old Wayne is getting soft in the head, read Lydia Bronte's *The Mercury In Your Mouth*, subtitled, "The truth about 'silver' dental fillings," citing such effects as fatigue, nervousness, headaches, memory lapses, allergies, depression, irritability, and lack of concentration. It's $15 from Quicksilver Press, 10

Continued on page 40



QRP VFO!

High power key pad controlled direct digital synthesis VFO for low power enthusiasts

Get base station performance from your QRP rig with keypad controlled VFO featuring:

- ✓ Keypad entry of frequency
- ✓ 10 Hz to 25 MHz frequency range
- ✓ Digital VFO with 10 Hz resolution & display
- ✓ Variable rate incremental keypad or rotary tuning
- ✓ Dual VFOs (A&B) allows cross band selection
- ✓ 100 memories for VFO A&B
- ✓ Keypad selection of bands
- ✓ RIT (+/- 9.99kHz)
- ✓ Size: L-4" X H-2.5" X D-0.9"

NEW!

Special limited time introductory price: $149 (U.S.)

Order now and also receive the RS-232 option to control VFO operation via your PC. Orders: 1-800-923-3423.

Info: (Tel.) 905-470-2900 (Fax) 905-470-6742.

Menu Plus

Menu Plus Inc.
1271 Denison St., Units 56-57
Markham, Ontario, Canada L3R 4B5

CIRCLE 335 ON READER SERVICE CARD

Number 6 on your Feedback card

LETTERS

From the Ham Shack

Nick Leggett N3NL. There is a company offering very large capacity capacitors (50F and larger) that may be very useful for amateur radio. The 50F double-layer capacitor measures 25mm in diameter and 40mm in length. It is rated at 2.5V, has .08Ω internal resistance, and sells in thousand lots for $13 each. The part number is DZ-2R5D506. The company offering them is ELNA America, Inc. 10529 Humbolt Street, Los Alamitos CA 90720. They have a web site at [http://www.elna-america.com]. This type of capacitor could be quite useful for amateur radio. Several can be used to store energy for portable and handheld devices. Think of the glorious time constant possible with 1000F of capacitance. Another, more unusual, use could be in a resonant circuit for the longwave experimenter's band.

I am personally interested in using these super capacitors for energy storage for model hovercraft, model electric aircraft, and model ionocraft. Probably the best place for a modeler to start is building a power boat. Boats have the least energy requirement. These capacitors could be a lot of fun for the experimenter and they could stimulate a lot of new ideas. These capacitors have the advantage of small size. They are designed to be mounted right on a circuit board. This is a contrast to the massive double-layer capacitors being used by electric vehicle researchers. Wouldn't it be good if amateur radio operators pioneered this type of development? Keep up your efforts promoting amateur radio research and invention. That is where the fun is and it is good for the nation.

It's difficult to tell the difference between large capacitors like these and batteries. I've been expecting miniature Farad capacitors ever since Takahashi got patents on a new dielectric a couple years ago. He's the chap who invented the super magnets used in his magnet-powered scooter ... Wayne.

Jack Lee KC5NGS. Wayne, we agree on so many issues that I just subscribed to *73*. I read your "Never Say Die" for the first time and can't wait for the next issue. I've been a ham for two years and just read my first *73* magazine. It's great! I agree that the code requirement should be reduced to 5wpm for HF privileges. I just upgraded to General Class. I enjoyed learning the code, but so many never meet the challenge. I say let's drop it and build our ranks. I sometimes think I may be off base, but then I read someone like you with many parallel views.

Thanks for the vote of confidence. If you happen to run into a thinking ham on the air, tell him about 73 ... Wayne.

Ron Gang 4X1MK. Say, I agree with almost everything you say but the business about beards. Well, I can't say if all college profs are masked bandits (hi), but being bearded is the male Homo Sapiens' natural state. Scraping of the facial hair with a blade is a custom of certain societies, attributed by some to Alexander of Macedon 2,000 years ago, who had his soldiers shave, so in battle, their opponents would not grab them by their beards and chop their heads off. I did indeed notice that in North America there are many fewer men with beards than here, no doubt due to social pressure. But since I gave up shaving 18 years ago, I haven't missed it a bit. I don't think of myself as a bearded person, just a regular person, and the lack of shaving didn't help me be more outgoing or any of that stuff, in fact I can't really think of any psychological changes that came with it. But I no longer suffer from rashes or other skin disorders on/of my face. I'm not putting down men with clean-shaven faces, if they like it, it's fine by me. A face is a face, and if it has a beard on it, that's part of it, as Nature has allowed. Nuff said on that point! On to more serious matters. I saw a device at the home of a friend in Canada that may interest you. I forget the name of its inventor (now the name Lakhovsky comes to mind), but the idea seems to be the same as the Bioelectrifier. In short, the device is a spark gap transmitter with continuous pulses of sparks fed into an antenna consisting of two disks of PC board with a circular kind of log-periodic etched out. You sit between these two poles, absorb the energy. The theory of Lakhovsky was that all cells have a resonant frequency, and disease happens when they go off their frequency. The pulses of wide-band RF knock them back onto frequency, and then everything is OK again. This may be a gross oversimplification, but that's how it was explained to me. There's literature out there and the device is commercially available. You're supposed to drink a lot of water after using the device, as there's a lot of detoxification happening in the body, and you need to drink the H_2O in order to flush out the poisons. And more serious matters. So, we've taken our bodies in hand, maximized our health. So what then? The most important thing may well be doing something with ourselves, the entities called human beings. Not just to amuse ourselves by various life games, like making money or amassing power. It would seem important that we maximize our potential in terms of becoming more aware, conscious. There may be clues in various esoteric traditions, many from (but not necessarily) the East. There are plenty of disciplines around for greater mental hygiene and unfolding the human potential. We've got to see if we can find out where we fit in with the whole scheme of things. G. I. Gurdjieff makes some interesting reading. Maybe hams may be more esoterically inclined. Is not the fascination with radio partly that it enables us to transcend the barriers of physical space and time and travel instantaneously far off? OK, pal. I've been reading your musings for over 30 years, so here were some of mine. Take care, and I can trust that you'll keep throwing in stuff to wake your readers out of their slumbers and think more about the nitty gritty.

No, Ron, amateur radio is a hobby. And the Lakhovsky oscillator is a lot like the Rife approach, except it creates more TVI. I'd sure like to see convincing evidence that either of these gadgets work so I could publish articles on them. Until then, they look like expensive placebo triggering devices to me. If there are any readers with solid data, I'd love to see it. Beards, some of them really weird, seem to be standard in Israel; over here they're more a way to either hide or flaunt one's face ... Wayne.

Warren Bain N4WMU. I have been reading your magazine for years and thoroughly enjoy it. I have found your editorials entertaining and informative, and have taken up several of your challenges, like NRA, Never Re-elect Anyone. It has not made any difference, though, since most people don't care or can't be bothered. I did order the NASA book, and to paraphrase General George C. Scott, René, you magnificent bastard, I read your book! I agree with many of his assertions. I am a reasonably good amateur photographer and have been looking at the NASA photos with a critical eye. I will go to the Air and Space Museum to get some of the photos and check them myself. I cannot agree with your assertion that a college degree is worthless, except your more Liberal Arts courses, as anything which makes you think is good. I received my BSEE and am better off since I can see through all the false technical claims which pass as information on various subjects. I bought the parts for the Bioelectrifier and will do some testing myself. Who knows? It may be the best thing since sliced bread.

College is fine if you have nothing better to do for four years and have no aspirations for making either money or a mark in the world—a profile that seems to fit a discouragingly high percentage of the motivationally challenged public ... Wayne.

Rick KE3IJ. I have really begun to appreciate your editorials; also appreciate your open-mindedness with regard to one of my areas of intense interest: "Weird Science" or, to put it more optimistically, Today's Dreams ... Tomorrow's Technology. I was particularly hoping to see an update on the fellow you mentioned who amplified biofields inside a Faraday cage and regenerated living organisms ... I've toyed with the same idea (but never got off my arse and did it!) ever since I ran across a series of books by Tom Bearden (Tesla Book Co.). Bearden is the father of "Scalar Electromagnetics," which is allegedly the missing link between mainstream electromagnetics/physics and the mysterious world of paranormal phenomena, electrogravitation, sub- or hyperspace communications, time-warping, and, related to the above, re-programming/regenerating a living organism by "correcting its scalar EM signature" (aura or biofield) via interfering Fourier expansion patterns to create a 3D "healing" field in and around that organism—a sort of synthetic "morphogenetic field" à la Rupert

Sheldrake. I recommend Bearden's many books highly if you haven't already run across them. He has one dealing with AIDS as a government-engineered virus and how Scalar EM could be employed as a healing means. I've also discovered quite a wealth of material on the Internet just by going to [http://www.yahoo.com] and typing searchwords such as psychotronics, biofields, phase conjugation, etc. One source, here in PA, allegedly invented and sells an electronic "aura reader" device said to operate on Resonant Field Imaging principles; his doodad supposedly correlates almost perfectly with the observations of clairvoyants who see certain colors in people's auras. He markets and consults to the alternative health crowd. Here are a few interesting web addresses if you're in a browsing mood. The Aura guy I just described: [www.thebook.com/mindbody/]; The KeelyNet, for which I occasionally write speculative files: [www.keelynet.com]; Leading Edge Research Group, an alt-sci/mystical site: [www.cco.net.~trufax/convers/conrpt.html]. Tom Bearden writes for the Huntsville AL *Virtual Times*: [www.hsv.com] (find Bearden among other writer links way down at the bottom of the page). There are lots more, of course. Just thought I'd let you know of some I've come across. And I am really "bugged" by your "biofield regeneration" anecdote. I wonder how wideband that wideband amp was. Assuming that our focus is in the audio band, what will happen feedback-wise if we use, not a microphone and a speaker, but a pair of Helmholtz coils (one pickup and one transmit) with positive feedback and our organism inside the field? With no acoustic feedback, "howling" would seem to be eliminated; RF oscillation shouldn't happen either if we limit the bandwidth. Can we saturate an animal in an amplified version of its own biomagnetic field, for good or ill effect? How about the problem of 3D? Should we have three pairs of coils, for X, Y and Z axes? I know, I know, I should get off my rumpus and *do* something.

You've mentioned the "crazy" books that call NASA's space program a staged farce; how about THIS one: SETI may be a farce, says a source I came across, because they're looking for ETs up in the MHz, etc., when NASA allegedly "knows darn well" that aliens use time compression (related both to Relativity and to Hartley's Bandwidth/Information equation) and communicate using what *we* perceive as ELF (such as brain-wave frequencies, Earth's Schumann resonances, etc., from 1-100 Hz). Such signals could be all around us, but we don't perceive them because they're too slow for us to hear; yet the aliens transmitting and receiving perceive them as at normal RF at MHz frequencies; their time-rate is different from ours. Think about the reports of UFOs flitting around at impossible speeds, dematerializing, and especially changing colors like a rainbow when accelerating. That sounds like Doppler shift of light, which could be observed if "time fields" could be created which "warp" an area with respect to the ambient ... just food for thought. Meanwhile, please keep up the good inspiring "Never Say Die" editorials and thanks for your time.

I've been reading Bearden's stuff for about 30 years now and it's never made any sense to me. Scalar-schmalar waves ... Wayne.

John Waudby KM6MB. I read René's books some time ago. One point: I was going through a CD-ROM yesterday and on it was the sound and video of the "first Moon landing." (I put it in quotes as I too am skeptical.) Lo and behold! I asked my XYL if she noticed anything odd and played it back several times, but she didn't. So I said, "Where is the delay?" I was taught that radio waves travel at or near the speed of sound. Well, someone should have told NASA! When ground control (or should I say the recording control room?) sent a "radio" message to the boys "attempting to land on the lunar surface" these boys answered as if they were in the same room. There was no delay!

Isn't the moon approximately 250,000 miles away? So shouldn't there be at least a second's delay? Find a copy, Wayne, and listen to it for yourself. I also put a Bioelectrifier together and use it for around 30 minutes a day. I hurt my wrist a few months back and noticed it relieved the pain. I'm also a "chrome dome" and I have noticed some comeback of my lost crowning glory!

Hmm, yes ... when I worked moonbounce ham contacts using the big dish at Arecibo there was about a three-second delay. Theoretically there should be about a one and a half-second delay for an Earth signal to get to the Moon and another second and a half for the response. Tsk ... Wayne.

Balaji Gopalakrishnan. I came to the US six months back from India for studies. Some days back I also began to revive my interest in ham radio. The result is I am now going to get an Advanced Class license (I took the exam seven days back). I cleared the 20wpm code test on my first exam ever. Although I did not study for "Extra" theory, I missed it by just one point.

I think the phenomenon you described in your "Never Say Die" column, of fewer and fewer people becoming hams, is a global phenomenon. Thankfully, most countries (including mine) don't have powerful companies (like AT&T, Raytheon, etc.) so we don't need to worry about our spectrum. Ham radio is taking a beating from the Internet, cellular phones, and the fact that people don't like to spend months learning an archaic language which they will never use outside the ham radio domain. I was an SWL for 10 years but could never get over the code barrier until I bought some practice tapes, so I now can receive well at 17wpm. I also assembled a QRP transceiver, which obviously is CW, so code does help in getting on the air if a ham does not have the resources to buy SSB high-power equipment. But it should not be a barrier to "the common people" from using voice on HF.

Coming back to the issue of spectrum space, I think we had better get used to losing parts of the spectrum. The positive side of this is that we will have to use equipment for narrower bandwidth, so people might go back to CW!

About the review in your May '97 issue of the WB9KZY Island keyer. It is not appropriate for the guy selling the keyer to review it.

I can't think of anything else to pour out to you (actually I had, but I can't remember).

Yes, now I've got it. The ARRL is barking up the wrong tree trying to lobby the companies trying to buy out spectrum. I think you're right, we need more political clout. And if we abolish CW for the license I think our ranks will swell like never before and everyone will be happy (ARRL, Yaesu, Kenwood, Icom ...) and with the increased numbers of hams we could possibly even justify keeping the spectrum.

Here's another troublemaker ... Wayne.

Dave Grieco K3KEM. Just a note to let you know I just finished building Tom Miller WA8YKN's Bioelectrifier. I picked up a blank circuit board from FAR Circuits at the Dayton Hamfest. I noticed that the printed circuit board from FAR has a few small errors in that some of the traces are incomplete, a mislabeled resistor (R6) and the polarity of the LEDs is reversed. Nothing you wouldn't miss while stuffing the board. I also noticed the values of C1 & C2 should be as close to each other as possible to keep the timing the same on each side of the current reversal (I opted for 47µF which gives a reversal time of about five seconds.)

Using 68k resistors in place of VR1 & VR2 will yield a current across the electrodes of up to 100mA! Using the 1 meg current pot in series with one output lead allows you to crank the current down to the 50 microamp range. I am pushing sixty and am in excellent health, so I have no ulterior motive to build the thing other than for the fun of it—although I could use a few extra hairs where I park my hat! The next step is to find some silver for the electrodes.

Sixty, and still healthy? Amazing! If you get desperate for 99.999 fine silver, Radio Bookshop has some available. I've been buying rolls of #10 pure silver wire and lopping off two three-inch lengths to help the readers make silver colloid ... Wayne.

Trevor Liberson GØMKO. I found *73 Magazine* while sailing in the USA last year. I was delighted with it, not only the style but the clear-thinking articles and the editorial. I would like to take it on a regular subscription basis but unfortunately my lifestyle prevents this. My wife and I did, however, benefit from this issue and let me explain. We live on a small sailing boat. We are currently cruising the Southern Caribbean. We came to Trinidad two months ago to watch the carnival. Carnival was great, but left us with its notorious aftereffect, "Carnival Flu," known also as "Carnival Crud" (by US sailors) or "Big Truck Flu" by the locals, even more devastating as we never get sick. We shook it off in a few days instead of the usual three weeks. Afterwards our thoughts began to turn to Thomas Miller's article on the Bioelectrifier. The idea of electronically bolstering the immune system seems mighty attractive, especially considering some of the nasties we meet in these parts, like

Continued on page 57

QRX . . .

Cause for Concern

We told you about the severe downturn in the sale of higher-profit desktop ham radio equipment in the United States. There are a number of industry observers who believe that this could lead to some Pacific Rim suppliers abandoning the US market.

The question then arises: If one (supplier) were to pull away from North America, what (would) happen to it? The answer is that any who do will not just survive but may even do better than continuing to deal with marketing to United States hams.

There are two reasons for this. First is the huge market in Japan where no-code hams are permitted to operate SSB phone on the high-frequency bands. In case you are not aware, Japan has more than six times the number of amateurs the United States has. And, unlike hams in North America, most Japanese radio amateurs purchase the newest and latest desktop high-frequency transceiver as soon as it's available. They are also used to paying full price with no discounts.

Also, there are the burgeoning South American and European markets. Again, discounting is unheard of and getting in line to be the first with a new-model radio is very common.

Most of the same Pacific Rim manufacturers that bring you ham radio gear also sell high markup two-way land mobile equipment. That market is exceedingly strong worldwide and offers profit margins that are generally quite high.

From the May 1997 issue of *Squelch Tale*, newsletter of the Chicago FM Club, Inc.

CQC Top Ten Secrets of QRP DXCC

10. Get a *Callbook* and a bunch of blank QSL cards and "Roll Your Own!"

9. Start sending or calling before the last guy has finished.

8. Break the pileup by working mixed-mode. When everyone is shouting their callsign, *send* yours in Morse.

7. Break the pileup by working mixed-mode (2). Really stir things up by shouting your callsign on SSB over a CW pileup.

6. If operating CW, sign "QRP YL." If operating phone, get a female or female impersonator to make the call.

5. Send a series of Vs at a kW before dropping back to 5 W to send your call. Gets their attention every time.

4. Get a QRO station to "relay" for you.

3. Run 100 W or more and sign "/QRP10MW."

2. Tell everybody you've *done* it, but just can't be bothered with the paperwork.

And the number one secret of QRP DXCC:

1. Just log it. If you could hear him, you *could* have worked him.

From *Low Down*, official journal of the Colorado QRP Club (cqc@aol.com).

Congress Acts to Protect Volunteers

We said it couldn't be done, and so naturally, Congress went and did it! In one of the more promising—not to mention surprising—developments so far in the 105th Congress, the Senate has passed S 544, and the House has passed a companion bill, HR 911, each described as "The Volunteer Protection Act of 1997." The Senate is expected to adopt the House version of the bill, HR 911, and send it along to the President for signature.

As a result, volunteers of non-profit organizations and government entities will, in the words of the House Judiciary Committee report on the bill, "generally be relieved of liability for harm caused if ... the volunteer was acting within the scope of the volunteer's responsibilities."

This will be good news to Volunteer Examiners, Official Observers, ARES and RACES volunteers and others working under the sponsorship of a qualifying non-profit organization, all of whom appear to be covered by HR 911. In non-legalese, this means that you aren't as likely to be sued as a result of harm unintentionally caused to someone else, if your actions were part of your responsibilities as a volunteer working on behalf of a government agency or a non-profit organization.

However, until the bill is signed by the President and its various loopholes pass the scrutiny of the legal community, volunteers shouldn't assume they'll automatically be covered. It appears, for example, that radio amateurs who are not working under the sponsorship of a qualifying organization and who volunteer to provide communications during a marathon, bicycle race or other public service or public safety event might not be covered. The same exclusion might apply to frequency coordinators and certain others who—though they are volunteers—aren't participating on behalf of a non-profit entity. While these individuals could affiliate with government or non-profit entities to do their volunteer jobs, the law will clearly protect only those who are "volunteers of a non-profit organization or government entity." The definition is clear with respect to government entities, but it is less clear with respect to "non-profit organizations." These can be Section 501(c)(3) entities, that is, an organization holding a certain tax exemption from the IRS. They also include, however, those organizations which may not be tax-exempt, but which are organized and conducted for public benefit and operated primarily for charitable, civic, educational, religious, welfare, or health purposes.

The growing reluctance of private citizens to volunteer for fear of lawsuits triggered interest in this legislation. While some states have enacted volunteer protection statutes, the inconsistency among states has resulted in what the Judiciary Committee calls a "hodgepodge." As a result, the League has promoted liability legislation in Congress for several years, initially to protect VEs and Amateur Auxiliary members.

The new legislation requires that the volunteer be licensed, certified or authorized, "if appropriate or required" by state or local authorities. It does not provide protection where the harm was caused by willful or criminal misconduct, gross negligence, reckless misconduct, or conscious, flagrant indifference to rights or safety of the individual(s) harmed by the volunteer. The House version of the legislation would not cover any volunteer who inadvertently caused harm to another person while operating a motor vehicle that requires an operator license or insurance. Also, certain limitations in existing state volunteer liability laws are not preempted by the Federal protection under the bill.

The ARRL's General Counsel Chris Imlay W3KD is studying copies of the House and Senate bills to determine the impact on amateur radio volunteers of the new legislation.

Copied from the June 1997 issue of the Maple Valley Amateur Radio Club's *Maple Valley Hamlink*; it originally appeared in the May issue of *The ARRL Letter*, prepared by the ARRL.

FCC Proposes, ARRL Opposes

Vanity fee hike... Last month, the FCC proposed effectively raising the fee for a vanity callsign from $30 to $50 for the 10-year license term. Now, the ARRL has asked the Commission to postpone the higher fee until after all four vanity callsign gates have been opened. In comments filed April 23, the ARRL told the FCC that it does not object to the fee increase, per se, but said that it wants all hams to have an opportunity to request a specific callsign under the current fee schedule.

The fee increase was among those included for all FCC-regulated services—including broadcasters and commercial satellite services—in the NPRM in MD Docket No. 96-186. Under the proposal, the FCC "rounded up" all FCC-imposed $3 annual fees to $5 per year—the lowest in the new schedule. The ARRL noted in its comments to the Commission that because projected revenue from the vanity fee increase "significantly exceeds" the revenue needed to cover the costs of administering the program, a delay would be reasonable. The ARRL also asked the FCC to limit the vanity callsign fee to the minimum it needs to recoup its costs to administer the vanity program but "without rounding to a significantly higher fee." The FCC adjusts its fee schedule every year.

TNX to the May 1997 issue of *The GCARC Wireless,* which reprinted from the *ARRL Website, Bulletin ARLB022.*

Video Transmitter

Delta—the ATV transmitter you can change to fit your needs.
Three bands, one design.

Jeff Johnson KC5AWJ
17423 Landon Oaks Drive
Houston TX 77095
[kc5awj@stevens.com]

ATV was the reason I got my ham license. Being able to talk to people without using Ma Bell was OK, but being able to see them at the same time—no slow scan for me—was *cool.*

I had been attending HATS and South Texas BLT meetings for several months before I got my ticket, and I was able to observe many different systems, both on 440 MHz and 1.2 GHz. I was a new ham with little or no equipment, no disposable income—but lots of spare parts. My options were down to one—build it myself.

I looked at all the circuits and equipment I could find, for ideas about which manufacturers made parts for ATV frequencies. By this time almost a year had passed and HATS had determined that the Houston area did not lend itself to in-band 440 MHz ATV. My focus was abruptly narrowed to creating a 1.2 GHz transmitter.

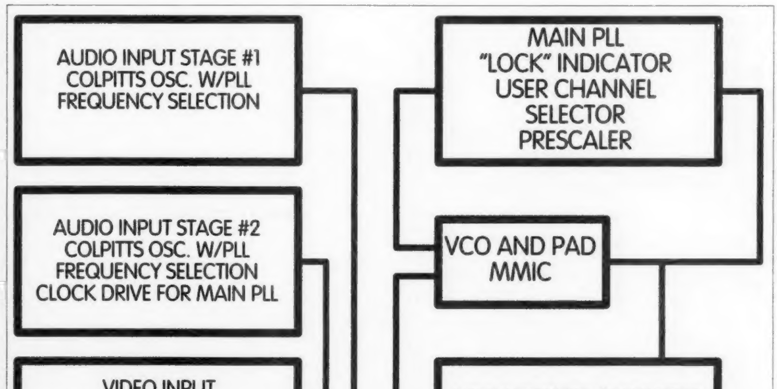

AUDIO INPUT STAGE #1
COLPITTS OSC. W/PLL
FREQUENCY SELECTION
AUDIO INPUT STAGE #2
COLPITTS OSC. W/PLL
FREQUENCY SELECTION
CLOCK DRIVE FOR MAIN PLL
VIDEO INPUT
NTSC PRE-EMPHASIS
NETWORK
DC POWER INPUT &
REGULATOR
MAIN PLL
"LOCK" INDICATOR
USER CHANNEL
SELECTOR
PRESCALER
VCO AND PAD
MMIC
HIGH POWER AMPLIFIER
3 dB PAD
OPTIONAL 50 mW AMP

Fig. 1. *System block diagram.*

Alpha board

I found a chip that would phase-lock a 1.2 GHz signal using a crystal control. This was great! A one-chip solution to my problem—and there were application notes for building a 1.5 GHz VCO to use with the chip, a Plessey SP5070F that cost about $17. Not too bad, I thought, and I didn't think the other parts would be any more difficult to find in small quantities. *Wrong!*

I could get samples of some of the parts but most had a minimum purchase quantity of 3,000-5,000 pieces. I spent several weeks searching for alternate sources and components, and finally wound up with enough samples to build two prototypes, following the VCO application note, and another eight or nine variations on the theme.

I created artwork and made the first circuit board. I had all the video components but couldn't find the transformer used in the audio circuit I had found in the *ARRL Handbook*. Well, I had bitten off a lot on this first board, so I gave up trying to find that stupid transformer and concentrated on the video section. Video pre-emphasis and two transistor gain stages weren't too hard to debug—but nothing came out the other end. It was at that point that I found out why they call them application "notes." Nice idea—but has anybody ever built it to see if it *works*? Two weeks later, after calls to anyone who would listen (and a few that didn't want to but did anyway), I'd got to the point of finding out where the free-running frequency of the VCO exited—disconnected from the PLL and video signals. Surprise! No wonder the PLL wouldn't/couldn't lock. It couldn't correct a VCO running 100 MHz too low on the voltage I had given it, and I didn't have a 17-volt car battery handy to correct the problem. I spent another week tweaking that sorry VCO. Actually, it wasn't *that* bad (I'm still married). But *now* I was getting cocky. I had a VCO that would free run at 1170 MHz. I reattached the PLL and it locked on frequency. Then I added the video.

A little more troubleshooting on the video board—and what do you know ... It actually worked.

Beta board

Some people were so impressed that I'd made a low-power ATV video-only transmitter for under $40 that they wanted one too. Buoyed by the fact that I'd survived the Alpha, I boldly conceived the next board—but I was smarter this time.

Audio would go on its own board until I resolved the parts problems it created. About that time I was shown an article from *VHF Communications* on a 13 cm ATV exciter. Their design had moved many of the "flying" parts onto a 50-ohm stripline on the PC board. This made a lot of sense: fewer parts to break off; a 50-ohm trace to make the MMIC amplifier happy; and a match to the coax going to the high power amplifier.

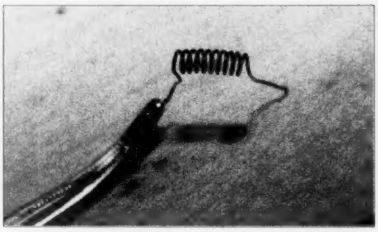


***Photo A.** Coil with both sides spread. No more curve!*

I was on the right track. Once more, I began creating different VCO designs using my free samples. I made up the first of eight boards and gave it to my first victim. He got it to work in a matter of hours, and made his own audio circuit. Unfortunately for him, my first victim did such a good job of making my mess work, he got to help with most of the rest of these little beasts. Somewhere around the seventh or eighth VCO, I got samples of a TriQuint general purpose downconverter, the TQ9272. One section of it contained a VCO with buffered outputs. All it

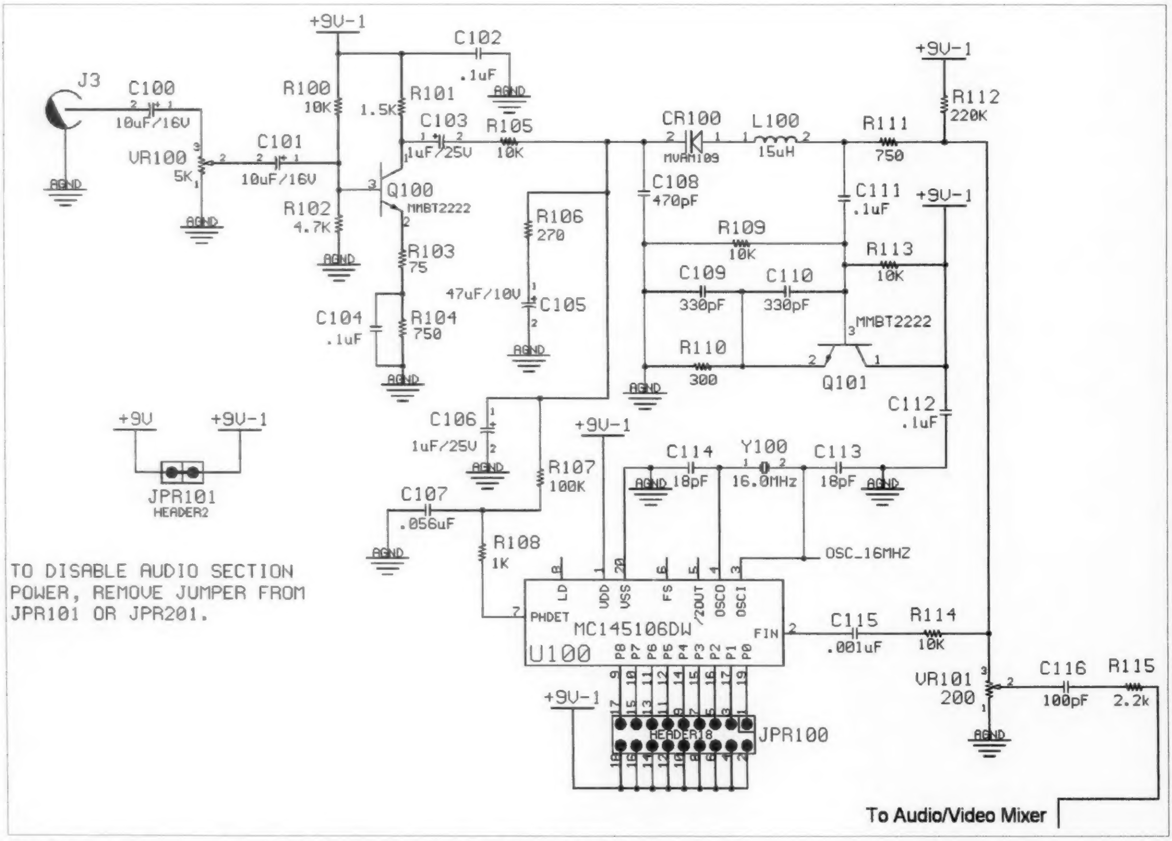

+9V-1
J3
C100
10uF/16V
VR100
5K
AGND
C101
10uF/16V
R100
10K
R101
1.5K
R102
4.7K
Q100
MMBT2222
R103
75
C104
.1uF
R104
750
C102
.1uF
C103
1uF/25V
R105
10K
R106
270
47uF/10V
C105
C106
1uF/25V
R107
100K
C107
.056uF
R108
1K
CR100
MVAM109
L100
15uH
C108
470pF
R109
10K
C109
330pF
C110
330pF
R110
300
R111
750
R112
220K
C111
.1uF
R113
10K
MMBT2222
Q101
C112
.1uF
C114
18pF
Y100
16.0MHz
C113
18pF
OSC_16MHZ
+9V
JPR101
HEADER2
TO DISABLE AUDIO SECTION POWER, REMOVE JUMPER FROM JPR101 OR JPR201.
LD
VDD
VSS
FS
/2OUT
OSCO
OSCI
PHDET
MC145106DW
U100
FIN
P8 P7 P6 P5 P4 P3 P2 P1 P0
HEADER18
JPR100
C115
.001uF
R114
10K
VR101
200
C116
100pF
R115
2.2k
To Audio/Video Mixer

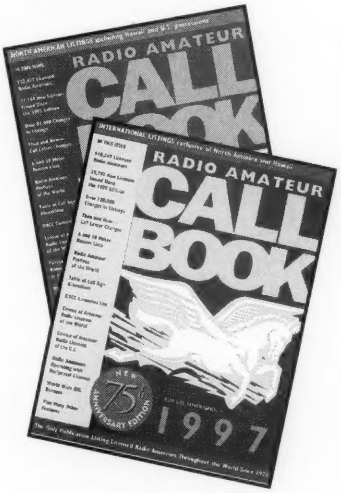
***Fig. 2.** First audio subcarrier. In all schematics, resistance is in Ω and capacitance in µF.*

Radio Amateur

CALLBOOK

Summer 1997

Here it is!
The CD-ROM
radio amateurs
are excited about!
SUMMER EDITION!



ANNOUNCING... THE CALLBOOK'S 75TH ANNIVERSARY!

...AND THE CD-ROM 1997 SUMMER EDITION THAT OFFERS UNMATCHED COVERAGE OF THE WORLD

The CD-ROM contains more than 1.4 million listings world-wide covering more than 250 countries, islands and dependencies. The Radio Amateur Callbook/CD-ROM contains both North American and International listings!

Listings can be found quickly by name, location and call letters–even when the information is incomplete!

- QSL Managers–We currently list over 54,000 entries.
- Browse feature

FEATURES

- Windows/DOS platform for US & international data retrieval
- Windows icon driven by mouse & DOS via menu
- Data display by callsign, last name, city, license class issue & expiration dates
- Search US stations by callsign, last name, county & zip code
- Search international data by callsign, last name, city or text search by name, street, city, province or region after selection of country
- Print labels from Windows/ DOS platforms. Windows application can do multiple label printing tasks.
- Listings of clubs, then and nows, military & silent keys
- US data includes time zones, latitude, longitude listings & area codes
- Morse code sound output to PC speaker

THE 1997 ANNIVERSARY EDITIONS OF THE NORTH AMERICAN AND THE INTERNATIONAL CALLBOOKS

Thousands of new licenses and over 100,000 updates are included in the industry's most reliable Callbooks. Order now while supplies last!

This will be the last edition of the paper Callbooks, and they will become collectors' item.

ORDER TOLL FREE

1-800-278-8477
Fax 1-908-363-0338
E-mail: 103424.2142
or fill out the coupon at right.
VISA/MC/AMEX accepted.

Radio Amateur Callbook
1695 Oak Street
Lakewood, NJ 08701

ORDERING COUPON

Please send me:

QTY.	ITEM	NUMBER	PRICE
______	North American Callbook	58913	$ 39.95
______	International Callbook	58905	$ 39.95
______	Callbook CD-ROM	RACD04	$ 49.95

If ordering by credit card: Card Type:________________ Exp. Date __________

Card # ______________________ Signature ______________________

Email address ______________________

If ordering by check or money order: I have enclosed a check/money order for $__________. (Please add sales tax in CA, DC, IL, MA, NJ, NY, OH, PA, TN, VA and Canada, and $5.00 per item for postage and handling in US; $7 for all shipments outside US.) Please include shipping instructions. Prepayment is required.

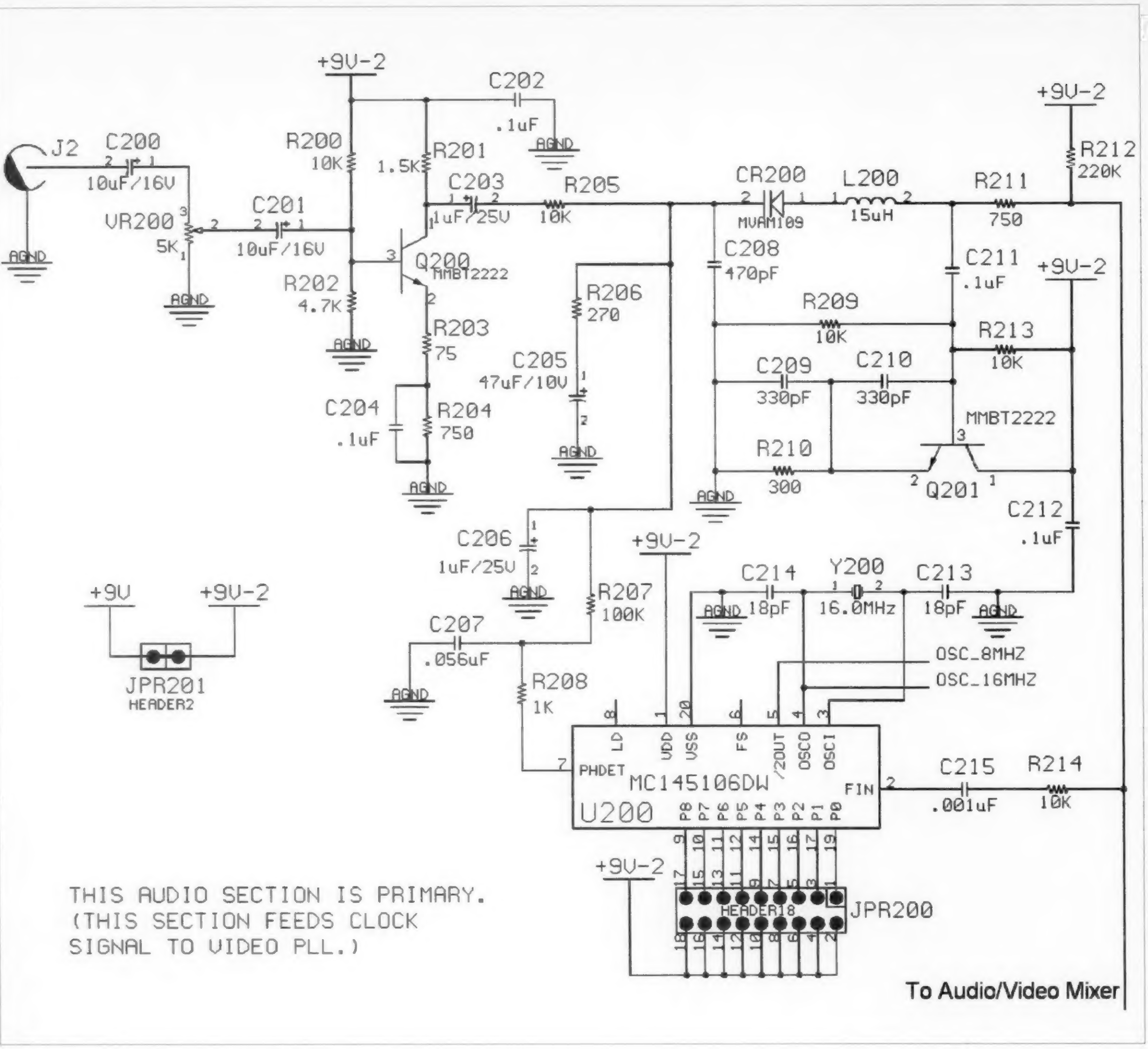

+9V-2
C202
.1uF
AGND
J2
C200
10uF/16V
VR200
5K
C201
10uF/16V
R200
10K
R201
1.5K
C203
1uF/25V
R205
10K
Q200
MMBT2222
R202
4.7K
R203
75
R204
750
C204
.1uF
C205
47uF/10V
R206
270
CR200
MVAM109
L200
15uH
R211
750
R212
220K
C208
470pF
C211
.1uF
R209
10K
R213
10K
C209
330pF
C210
330pF
MMBT2222
R210
300
Q201
C212
.1uF
C206
1uF/25V
R207
100K
C207
.056uF
R208
1K
C214
18pF
Y200
16.0MHz
C213
18pF
OSC_8MHZ
OSC_16MHZ
+9V
JPR201
HEADER2
PHDET
LD
VDD
VSS
FS
/2OUT
OSCO
OSCI
FIN
MC145106DW
U200
P8 P7 P6 P5 P4 P3 P2 P1 P0
C215
.001uF
R214
10K
HEADER18
JPR200
THIS AUDIO SECTION IS PRIMARY.
(THIS SECTION FEEDS CLOCK
SIGNAL TO VIDEO PLL.)
To Audio/Video Mixer

***Fig. 3.** Second audio subcarrier.*

needed was a small inductor—a short piece of wire—to set the general oscillation frequency. The downside? It cost $25 each in quantities of 25 or more.

Charlie board

The most obvious problem with the prior boards had been the inability to create reliable quantities of VCOs. The second problem was inherent in the SP5070: a fixed prescaler divide ratio with a PLL using a set divide and comparison ratio. What all that jargon means is that I could have only as many frequencies as I could find crystals to create them. This meant one or two frequencies using readily available crystals; any other frequencies would be special-order, big-bucks crystals. The third problem was finding a good audio design with parts that could actually be purchased in *reasonable* quantities.

The entire process seemed to be a guided evolution. I just didn't know who was doing the guiding. I'd been searching for something but didn't know what I was looking for.

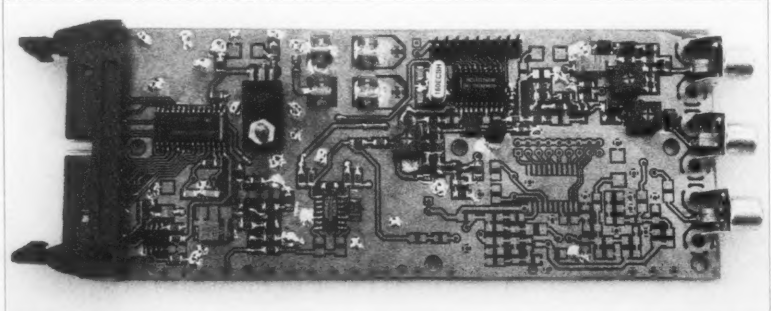


***Photo B.** Audio/video section of completed Delta transmitter (only one audio section used).*

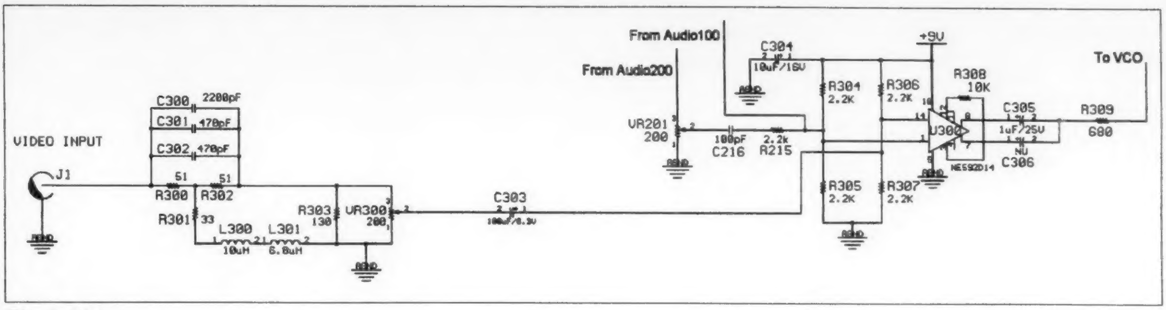


Fig. 4. Mixer.

Another HATS member gave me a copy of a magazine, and inside was a small ad: VCOs for under $10. I figured I had nothing to lose and gave them a call. Yes, they would sell smaller quantities, but the price was higher than the TriQuint part. These nice folks offered to match TriQuint's price to be "designed in." My VCO creation problems were over.

I was working on another project at my *real* job, which required me to look in a data book I had never paid much attention to. This wonderful book was the *Motorola CMOS Special Applications Handbook*. Inside were more PLLs than I had found in the previous two years. What made it especially nice were two parallel programmable PLLs. This meant I would not need a microcontroller to run an I2C bus or serial interface to the PLL. I could use a DIP switch. I would no longer have a one-chip solution; it would take two chips—but I gained hundreds of frequency selections.

The problem with the audio design was not so much its design as the parts I was trying to use. Although the varactor diode was a "preferred part" it also had a 20+ week lead time in minimum quantities of 5,000. Would you believe the part I needed was one page back from the part I couldn't get? It wasn't much bigger, cost half as much, was in stock for immediate shipment, and I could buy it in quantities of one. Yes, *one*.

Gee, wouldn't it be nice if someone else did all the bleeding for you? Well, how about burnt fingers and a couple square feet of mangled copperclad? Forthwith and hereafter, I present a design which shall be known as "Delta," containing the bits and pieces of knowledge I have gained/lost over the past three years in pursuit of a design for an ATV transmitter.

Frequency Range	860–1300 MHz, 2300–2500 MHz (Use only in authorized frequencies)
Channel selection steps	.25 MHz, 1 MHz
Output power	50 mW–2.5 W(+)
Video input level	1V p–p into 75 ohms
Video pre-emphasis	CCIR 405–1
Video modulation	Direct FM (up to 20 MHz bandwidth)
Audio input level	1V p–p into 5k ohm
Audio modulation	Direct FM (subcarrier(s) summed with video)
Audio subcarrier frequency	4–6.2 MHz
Audio step size	10–31.25 kHz (dependent on crystal selection)
Input connectors (3)	RCA
Output connector (1)	SMA
Input voltage	10.5–15 VDC

Table 1. Specifications.

ISOTRON
ANTENNAS FROM 160-10 METERS
NO TUNERS
NO RADIALS
NO COMPROMISE
PRICES START AT $49.95
SEVEN EXCELLENT REVIEWS
JUST DON'T HAPPEN BY CHANCE
CALL US FOR A FREE CATALOGUE
See review in 73, Oct. 1984; 73, Sept. 1985; 73, March 1986 CQ, Dec. 1988; W.R., Mar. 1991; 73, Nov. 1994; 73, Apr. 1996
ASK ABOUT OUR NEW ISOTRON 160C!
BILAL COMPANY
137 MANCHESTER DRIVE
FLORISSANT, COLORADO 80816
(719) 687-0650
CIRCLE 42 ON READER SERVICE CARD

GRUNDIG YB-400

"The compact model most preferred by our panelists for listening to major worldband stations... audio quality is tops within its size class."
Passport to Worldband Radio
Here's everything you want at a price you can afford. The Grundig YB-400 covers LW, MW, FM and all of SW. An illuminated LCD reads to 1 kHz on SW. Enjoy smooth SSB with fine tuning knob. Tune your favorite stations instantly with keypad entry or 40 memories. Other features include: dual digital clock-timer with snooze and dial lock. Switches for: Wide-Narrow, Local-DX and Hi-Low Tone. Supplied with six AA cells, carry case, wind-up antenna, manual and Grundig Wave Guide. #0040 $169.95 (+$6)
Universal has a limited number of like-new Factory Reconditioned YB-400s. All accessories and same one year limited warranty. #1704 $149.95 (+$6)
Order now and get a FREE radio stand and a FREE copy of DX Tips For Beginners with your YB-400!
universal radio inc.
Universal Radio
6830 Americana Pkwy.
Reynoldsburg, OH 43068
◆ Orders: 800 431-3939
◆ Info: 614 866-4267
◆ FAX: 614 866-2339
www.universal-radio.com
Quality Communications Equipment Since 1942

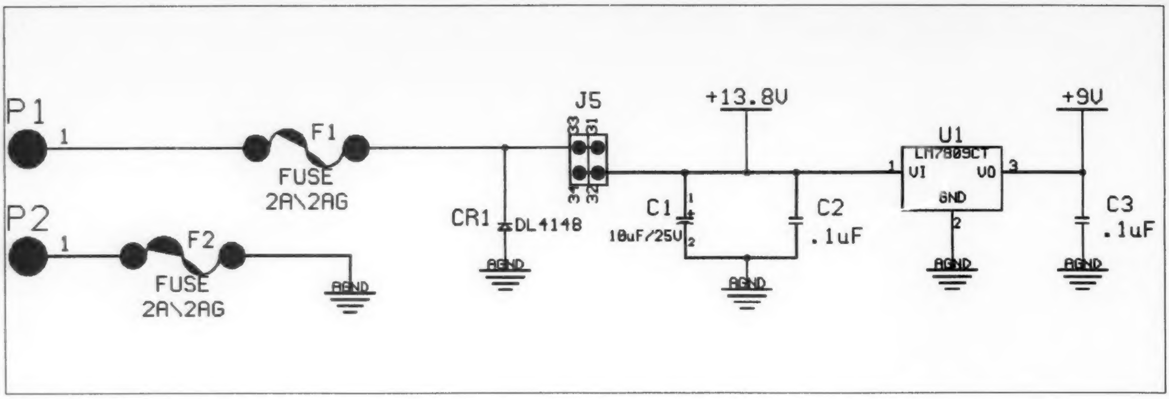


Fig. 5. Power input section.

Delta board

Some new features:

- •Two audio channels with separate PLLs (stereo, or mono and one control frequency) and use of one, two, or three crystals for oscillation reference
- •Board can separate into three modules—audio/video control, video, and amplifier module (high power: 2.5 W or low power: 50 mW)—for R/C and portacam use
- •Uses a smaller, cheaper VCO with more available frequencies
- •You get 900 MHz, 1.2 GHz, and 2.4 GHz with same board design
- •Replacement of DIP switch (the contacts bounced in RC aircraft), power switch, and lock indicator with header strip allowing quick frequency changes using pre-made "keys" (uses 34-pin header, floppy disk cable)
- •Unused audio sections can be powered down for power conservation

Don't be scared by the schematic. The way printed-circuit software works is that if you want an option it has to be on the schematic. There are lots of options here! The nice thing about this board is that you only need to stuff parts in the sections you want to use. The component numbers are broken up into

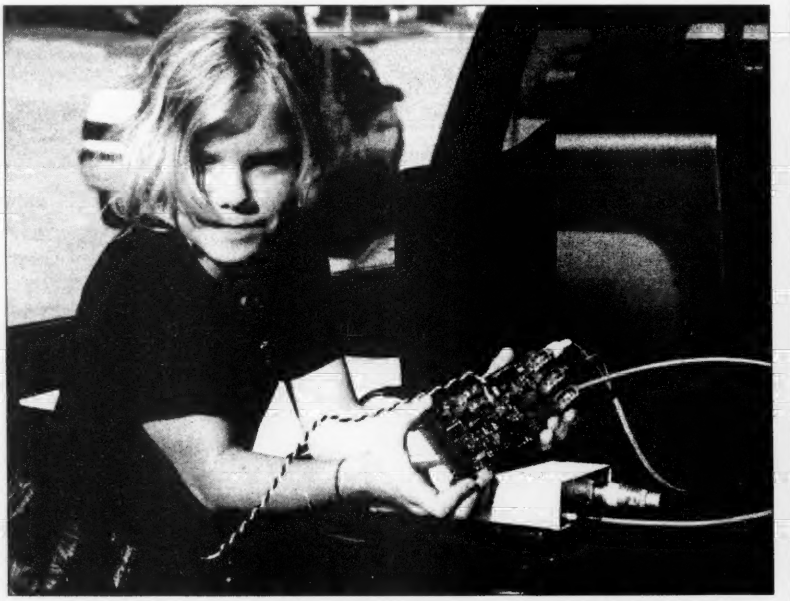


***Photo C.** Can I touch it? Am I holding it just right? Daughter Meredith holds ready-to-go Delta—just add power.*

Where's the Beam?
Unobtrusive DX Gain Antennas for 80 thru 10
• Easily hidden • Install Fast • Fixed or Portable •
There's a 20 meter antenna with real DX Punch hidden in this picture. You can't see it, and your neighbors can't either. But it works DX barefoot anyway. How about a low profile 80 40 30 tribander? Or a 2 element monobander for the attic? All easily fit the pocketbook--Priced $29 to $99.
Work DX without telling the neighbors
Infopack $1
AntennasWest
Box 50062-R, Provo, UT 84605
(801) 373-8425
CIRCLE 332 ON READER SERVICE CARD

BIOELECTRIFIER
PLANT GROWTH STIMULATOR
• COMPACT SIZE, 4.5" X 2.25" X 1"
• ADJUSTABLE OUTPUT UP TO 25 VOLTS
• STAINLESS STEEL ELECTRODES
• WIRED AND TESTED
FOR MORE INFORMATION
SEND SASE TO:
SEAGON COMPANY
5541 OAKVILLE CENTER
SUITE 215
ST. LOUIS, MO 63129
CIRCLE 241 ON READER SERVICE CARD

functional groups: the 100s and 200s are the two audio subcarriers; the 300s are the video amp section; the 400s are the main PLL and its circuits; the 500s are the VCO and buffer amp; and the 600s are the high-power amplifier for 1.2 GHz or the low-power amplifier for 900, 1200, and 2400 MHz.

The sections that will always be used are: the power input section (fuses and voltage regulator); the video amp section (NTSC pre-emphasis, combines video with audio channels); the main PLL with prescaler; and the VCO with buffer amp and pads. It wouldn't be ATV if it didn't have the video stuff. For those of you who want sound with your video the two audio channels can create stereo, or mono and a control frequency, or just mono.

The schematic as written is specifically for 1.2 GHz operation due to the frequency limitations of U600 (1240-1300 MHz). The VCO (U500) can operate from 860-1300 MHz. By using U601 (500-2500 MHz) in place of U600, you now have a dual-band transmitter with an output of 50 mW. The VCO and prescaler can be exchanged for other devices in the same size (parts list has device numbers) and will then transmit in the 2.4 GHz band with a 50 mW output. Additional amplifiers can be added outside of this assembly to allow as much power as the owner can afford.

What do you want to do?

After you have created/bought the printed circuit board the next step is to determine what you want the board to do and purchase parts accordingly. Will it be a base station transmitter? A portable camera with a link transmitter? Used in an R/C model? What frequency(s) do you want to use? Do you need one audio channel? Stereo? Two selectable mono audio channels set to different frequencies? How much output power is required? All of the above? Better make another board, or perhaps two.

Assembly

The air core inductor (L500) is made from #26 AWG magnet wire wrapped ten times around a form (piece of bare #12 AWG solid copper wire). Wrap the wire around the form in a tight single layer. Remove from the form, and, using a hobby knife blade (an X-ACTO™ #10 works for me), spread the windings apart by the thickness of the knife blade. Do this gently: you don't want to nick the wire or your fingers. One pass on each side of the coil will spread the wire uniformly. Remove insulation (carefully scrape with knife blade or use insulation solvent) for approximately one-half inch close to coil ends. Trim and form leads to fit pads on circuit board.

Remove some of the material from around the outside row of pins on connector J5. This will allow more room for the solder iron tip and make inspection easier. After soldering in J5, use an ohmmeter to check continuity between each pin and its destination. Also check for shorts between adjacent pins and to ground. The jumper headers can also be trimmed to ease soldering. Insert the headers and tack them in place from the bottom of the board. Carefully trim the plastic from the outside edges of the header until the component side pad is visible. Finish soldering the header in place. All through-hole parts should be installed first, and checked for shorts and continuity.

If you are using a commercially-made board, assembly is easiest if you solder the parts from smallest to largest, with the through-hole parts assembled last. If you have made your own board and did not do plated-through holes (they are beyond the capabilities of most hobbyists) you will want to do all of the through-hole parts first and then the surface-mount ones. Surface-mount parts have all of their electrical connections on one layer—the layer you can see. Through-hole parts connecting to traces on the bottom are easily inspected, but the traces on top are difficult to solder without leaving some space under the part, to

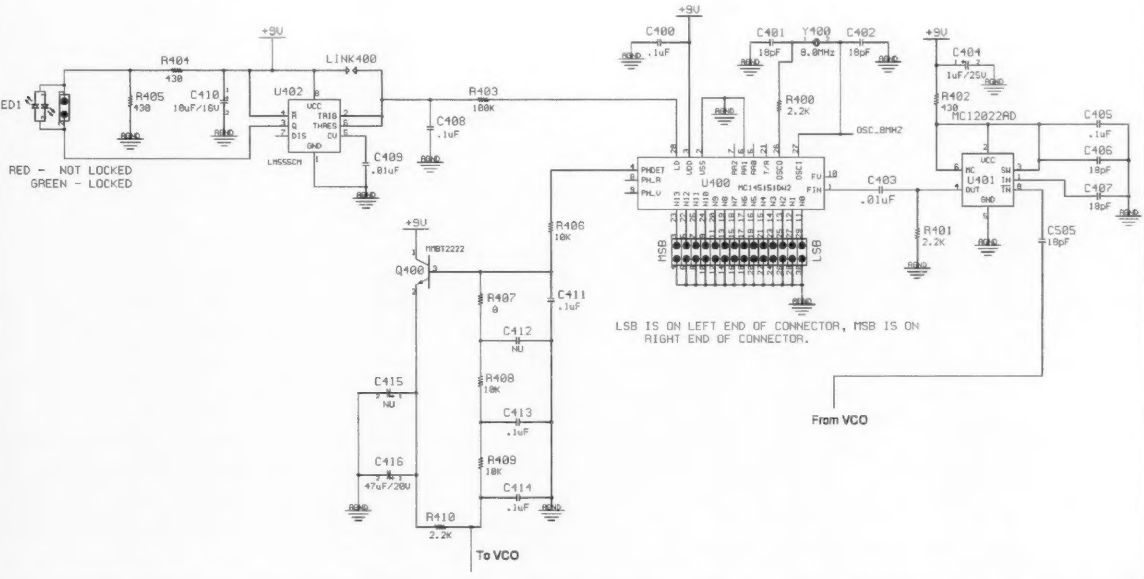

+9V
R404
430
LINK400
LED1
R405
430
C410
10uF/16V
U402
VCC
R
Q
DIS
TRIG
THRES
CV
GND
LM555CM
R403
100K
C408
.1uF
C409
.01uF
AGND
RED - NOT LOCKED
GREEN - LOCKED
C400
.1uF
C401
18pF
Y400
8.0MHz
C402
18pF
R400
2.2K
OSC_8MHZ
PHDET
PH_R
PH_V
LD
VDD
VSS
RA2
RA1
RA0
T/R
OSCO
OSCI
FV
FIN
U400
MC145151DW2
N13
N12
N11
N10
N9
N8
N7
N6
N5
N4
N3
N2
N1
N0
MSB
LSB
C403
.01uF
R401
2.2K
C404
1uF/25V
R402
430
MC12022AD
U401
MC
OUT
SW
IN
GND
C405
.1uF
C406
18pF
C407
18pF
C505
18pF
MMBT2222
Q400
R406
10K
R407
0
C411
.1uF
C412
NU
R408
10K
C413
.1uF
R409
10K
C414
.1uF
C415
NU
C416
47uF/20V
R410
2.2K
To VCO
From VCO
LSB IS ON LEFT END OF CONNECTOR, MSB IS ON RIGHT END OF CONNECTOR.

Fig. 6. Main PLL.

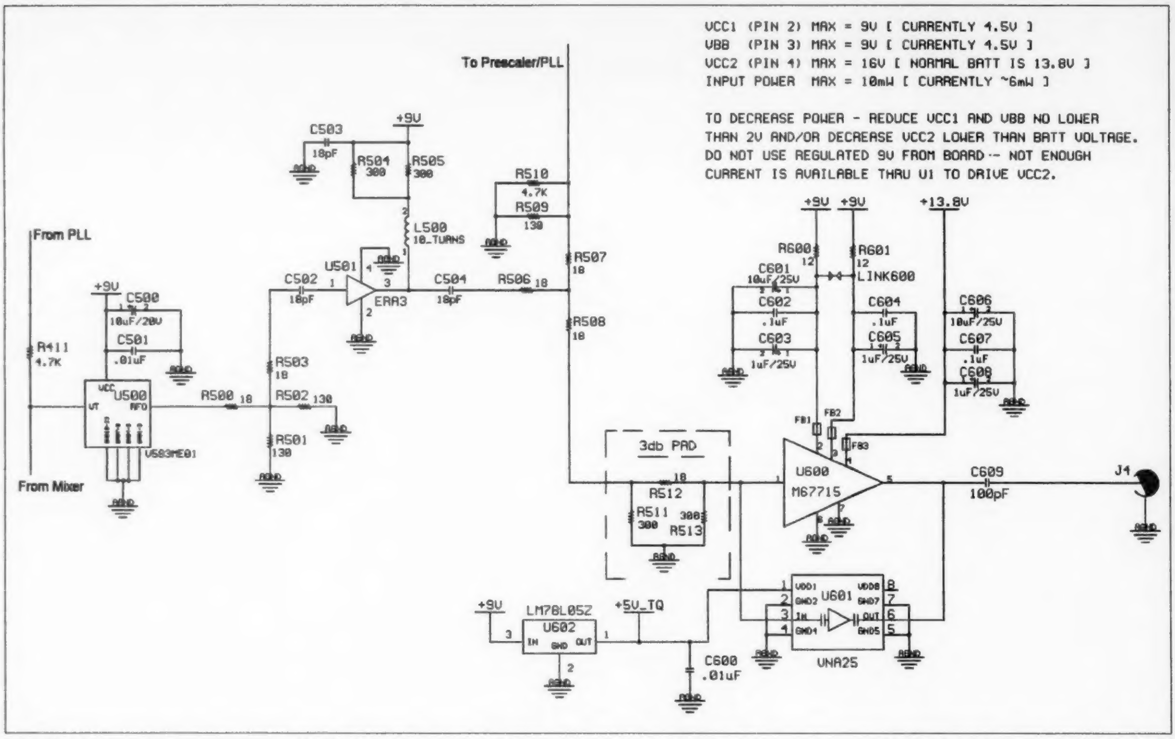

VCC1 (PIN 2) MAX = 9V [CURRENTLY 4.5V]
VBB (PIN 3) MAX = 9V [CURRENTLY 4.5V]
VCC2 (PIN 4) MAX = 16V [NORMAL BATT IS 13.8V]
INPUT POWER MAX = 10mW [CURRENTLY ~6mW]
TO DECREASE POWER - REDUCE VCC1 AND VBB NO LOWER THAN 2V AND/OR DECREASE VCC2 LOWER THAN BATT VOLTAGE. DO NOT USE REGULATED 9V FROM BOARD -- NOT ENOUGH CURRENT IS AVAILABLE THRU U1 TO DRIVE VCC2.
To Prescaler/PLL
From PLL
From Mixer
C503 18pF
+9V
R504 300
R505 300
L500 10_TURNS
R510 4.7K
R509 130
U501 ERA3
C502 10pF
C504 10pF
R506 18
R507 18
R508 18
C500 10uF/20V
C501 .01uF
R411 4.7K
U500 U503ME01
R500 18
R502 130
R503 18
R501 130
R600 12
R601 12
LINK600
C601 10uF/25V
C602 .1uF
C603 1uF/25V
C604 .1uF
C605 1uF/25V
+13.8V
C606 10uF/25V
C607 .1uF
C608 1uF/25V
FB1
FB2
FB3
3db PAD
R512 18
R511 300
R513 300
U600 M67715
C609 100pF
J4
LM78L05Z U602
+5V_TQ
C600 .01uF
U601 UNA25
GND

Fig. 7. High- and low-power amp. VCC1 (pin 2) max = 9 V (currently +4.5 V). VBB (pin 3) max = same. VCC2 (pin 4) max = 16 V (normal battery is 13.8 V). Input power max = 10 mW (currently ~6 mW). To decrease power, reduce VCC1 and VBB no lower than 2 V and/or decrease VCC2 lower than battery voltage. Do not use regulated 9 V from board—there is not enough current available through U1 to drive VCC2.

TNT
Today's No-Tune Multiband Antenna
No pruning. No tuning. No knobs to twist.
TNT is No-Tune on 80 cw, 40, 20, 17, 12, 10. TNT/2 is No-tune on 40, 20, 10. Work other bands w/ tuner. DX &Gain rise w/ frequency.
Ready to Use
Includes isolation balun & 99 ft RG8x
Kink-Proof
Wx-Sealed
Low Noise
No Traps or Resistors
Insulated to 3000 V
Rated 500 Watts
The modern coax-fed version of the classic off-center fed windom.
Technote 126--$6.95 ppd
TNT Windom $89.95 +$8 P&H 135 ft. long
TNT/2 Windom $79.95 +$7 P&H 67 ft. long
AntennasWest
Box 50062S, Provo, UT 84605
Order Hotline 800-926-7373
CIRCLE 135 ON READER SERVICE CARD

From Micro Computer Concepts
RC-1000 REPEATER CONTROLLER
• Autopatch • Reverse Autopatch
• User Programmable CW ID, Control & User Codes & Timeouts
Manual with schematics • 90-Day Warranty
Wired & Tested w/ manual $199.95
VISA
MasterCard
Micro Computer Concepts
8849 Gum Tree Ave.
New Port Richey, FL 34653
813-376-6575
CIRCLE 160 ON READER SERVICE CARD

heat the lead and the pad. It also helps if you install the parts with larger quantities first. This makes it easier to tell where the single parts go because there are fewer places to look.

If you're making the high-power version, do not install U600 until the board has been tested and all functions are working. It's much easier and safer to test small signals than large signals.

Why three crystals?

The board needs one crystal to operate in standard mode. A 16 MHz crystal at Y200 provides reference frequencies to both audio oscillators, and using the /2 output of the audio PLL provides the 8 MHz reference for the video PLL. The board artwork connects Y100 and Y200 together and provides the /2 signal from U200 to the video section. By having the option of three crystals, I can separate the crystals from each other by removing a section of the trace connecting the two audio PLL crystal inputs together and have the video using an 8 MHz crystal (250 kHz steps at 1.2 GHz, 1 MHz steps at 2.4 GHz), one audio channel using 16 MHz (31.25 kHz steps), and the other audio using 10.24 MHz (10 kHz steps—but maximum frequency is 5.12 MHz). Any crystal can be used in the audio channels, provided the divide ratios work out to a whole number with no remainder, or the PLL will oscillate and be unable to lock.

Divide ratios of PLLs

Formulas for the MC145106:

PLL reference frequency:

(ref. crystal input freq.)(divide by 2)(divide by 2e9 or 2e10)

Oscillator frequency:

(oscilator output freq.)(divide by N) with N being the binary inputs P0 to P8.

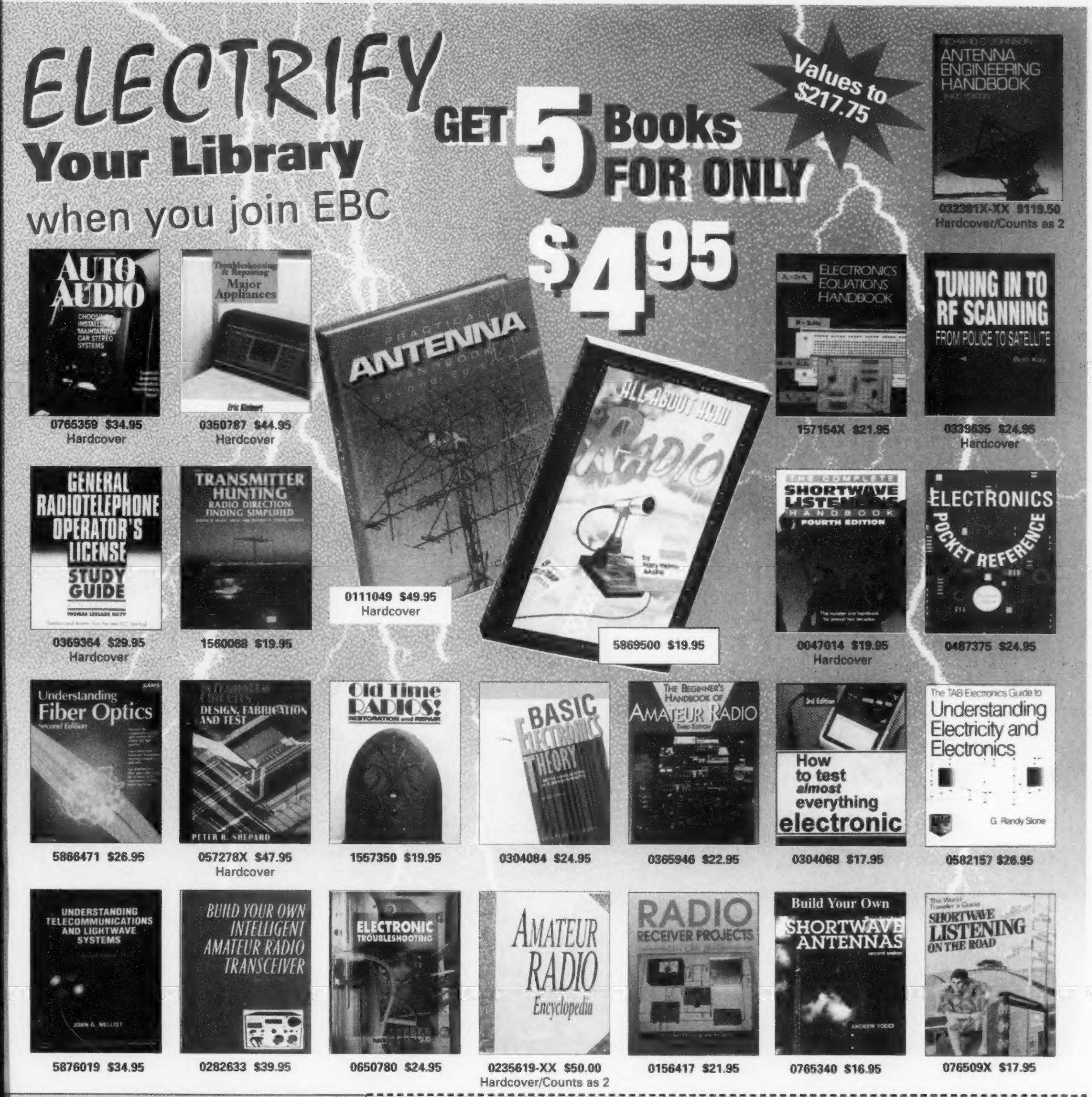
EXAMPLE:

16 MHz crystal installed, 5.25 MHz oscillator output frequency desired.

16 MHz input divided by 2 = 8 MHz.

8 MHz divided by 512 (2e9) = 15.625 kHz.

15.625 kHz, or 0.015625 MHz, is our step frequency.


ELECTRIFY Your Library when you join EBC
GET 5 Books FOR ONLY $4.95
Values to $217.75
ANTENNA ENGINEERING HANDBOOK
AUTO AUDIO
Troubleshooting & Repairing Major Appliances
PRACTICAL ANTENNA HANDBOOK
ALL ABOUT HAM RADIO
ELECTRONICS EQUATIONS HANDBOOK
TUNING IN TO RF SCANNING FROM POLICE TO SATELLITE
GENERAL RADIOTELEPHONE OPERATOR'S LICENSE STUDY GUIDE
TRANSMITTER HUNTING RADIO DIRECTION FINDING SIMPLIFIED
THE COMPLETE SHORTWAVE LISTENER'S HANDBOOK FOURTH EDITION
ELECTRONICS POCKET REFERENCE
Understanding Fiber Optics
DESIGN, FABRICATION AND TEST
Old Time RADIOS! RESTORATION and REPAIR
BASIC ELECTRONICS THEORY
THE BEGINNER'S HANDBOOK OF AMATEUR RADIO
How to test almost everything electronic
The TAB Electronics Guide to Understanding Electricity and Electronics
UNDERSTANDING TELECOMMUNICATIONS AND LIGHTWAVE SYSTEMS
BUILD YOUR OWN INTELLIGENT AMATEUR RADIO TRANSCEIVER
ELECTRONIC TROUBLESHOOTING
AMATEUR RADIO Encyclopedia
RADIO RECEIVER PROJECTS
Build Your Own SHORTWAVE ANTENNAS
SHORTWAVE LISTENING ON THE ROAD

032381X-XX $119.50 Hardcover/Counts as 2

0765359 $34.95 Hardcover

0350787 $44.95 Hardcover

0111049 $49.95 Hardcover

5869500 $19.95

157154X $21.95

0339635 $24.95 Hardcover

0369364 $29.95 Hardcover

1560068 $19.95

0047014 $19.95 Hardcover

0487375 $24.95

5866471 $26.95

057278X $47.95 Hardcover

1557350 $19.95

0304084 $24.95

0365946 $22.95

0304068 $17.95

0582157 $26.95

5876019 $34.95

0282633 $39.95

0650780 $24.95

0235619-XX $50.00 Hardcover/Counts as 2

0156417 $21.95

0765340 $16.95

076509X $17.95

As a member of the ELECTRONICS BOOK CLUB...

you'll enjoy receiving Club bulletins every 3-4 weeks containing exciting offers on the latest books in the field at savings of up to 50% off the regular publishers' prices. If you want the Main Selection, do nothing and it will be shipped automatically. If you want another book, or no book at all, simply return the reply form to us by the date specified. You'll have at least 10 days to decide. If you ever receive a book you don't want due to late delivery of the bulletin, you can return it at our expense. Your only obligation is to purchase 2 more books during the next 12 months, after which you may cancel your membership at any time. And you'll be eligible for FREE BOOKS through our Bonus Book Program.

A shipping/handling charge and sales tax will be added to all orders. All books are softcover unless otherwise noted. Publishers' Prices Shown © 1997 EBC

If card is missing, write to:
Electronics Book Club®
A Division of The McGraw-Hill Companies
P.O. Box 549, Blacklick, OH 43004-9918

Electronics Book Club®
A Division of The McGraw-Hill Companies

☐**YES!** Please send me the books listed below, billing me just $4.95, plus shipping/handling & tax. Enroll me as a member of the **EBC** according to the terms outlined in this ad. If not satisfied, I may return the books without obligation and have my membership cancelled. I agree to purchase just 2 more selections at regular Club prices during the next 12 months and may resign anytime thereafter.

If you select a book that counts as 2 choices, write the book number in one box and XX in the next.

Name______________________________

Address/Apt. #______________________________

City/State____________________Zip__________Phone__________

Valid for new members only, subject to acceptance by EBC. Canada must remit in U.S. funds drawn on U.S. banks. Applicants outside the U.S. and Canada will receive special ordering instructions. A shipping/handling charge & sales tax will be added to all orders.

STAR997

☎ **PHONE: 1-614-759-3666** (8:30 a.m. to 5:00 p.m. EST Monday-Friday) • **FAX:1-614-759-3749** (24 hours a day, 7 days a week)

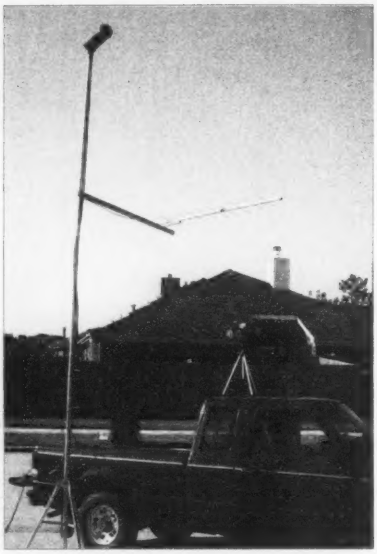


Photo D. *Portable system configuration used during this year's March of Dimes Walkathon. Note Delta board to left of TV, above rear wheel.*

5.25 MHz divided by (N) must = 15.625 kHz or 0.015625 MHz.

Therefore 5.25 MHz divided by 0.015625 MHz = 336.

336 = 256 + 64 + 16.

Inputs P8, P6, and P4 should be connected to the positive voltage supply. All of the P0-P8 pins have internal pull-down resistors and are at ground potential and inactive unless connected to the positive supply. Each audio section is independently powered, allowing unused sections to be turned off.

Formulas for the MC145151

PLL reference frequency:

(ref. crystal input freq.)(divide by reference address divide ratio value) = phase detect frequency

The reference divide ratio is set by connecting RA0-RA2 to ground per the manufacturer's table. The artwork sets this ratio at 2048. Other ratios would require "cuts and jumps" to connect the appropriate pins to analog ground (AGND).

Oscillator frequency

(oscillator output freq.)(divide by prescaler ratio)(divide by N)

with N being the binary inputs N0 to N13.

The prescaler ratio is set to 64 by artwork connections to VCC on pins 3 and 6. This ratio will allow 0.25 MHz steps on the 900 MHz and 1.2 GHz bands. For usage on the 2.4 GHz band, a different prescaler chip (MC12032A) should be used and pin 6 connected to VCC giving a divide ratio of 128.

EXAMPLE:

8 MHz crystal installed, reference address divide ratio of 2048 is used. Prescaler divide ratio is set at 64. 1280 MHz oscillator output frequency desired.

8 MHz input divided by 2048 = 0.00390625 MHz.

0.00390625 MHz is our phase detect frequency.

1280 MHz divided by (64) = 20 MHz.

Then 20 MHz is divided by 0.00390625 MHz = 5120.

5120 = 4096 + 1024.

Inputs N12 and N10 should be connected to AGND. This is the opposite of the MC145106! The MC145151 has its input pins and reference address pins pulled up by internal resistors and are at positive voltage potential and inactive unless connected to ground. I guess these chips were done by two different groups—one group that preferred pull-down and the other group preferring pull-up. I have designed the artwork where a closed connection indicates the selection of that pin on the PLL to its active state. For those of you familiar with logic levels this will drive you nuts. Please remember the two PLL chips are opposite if you must use a voltmeter to troubleshoot your frequency keys.

Applying power

Do *not* power up the transmitter without connecting an antenna or dummy load to the output. This is a good practice to get into, even if the board would not be damaged. Antennas should be pointed away from organic life. Exposure to high-frequency energy can cause permanent damage, especially to eyes.

The board should be tested prior to installation of the high-power amplifier. The 50 mW section can be tested along with the rest of the board if your test equipment can survive the 50 mW as an input.

Connect board to power supply and verify correct voltages are being seen at all areas of the circuit. Check for hot parts: Under proper operation everything should be cool to the touch except the regulator (warm after 30 minutes) and the power amplifier (slowly warm to very warm after 30 minutes).

Troubleshooting

Most of the problems you'll encounter in building this board will be bad solder joints. The first thing to do is determine which section of the board is not functioning properly; make sure the power is turned off, and check all the solder joints in the section, touching up the joints that look suspicious. Reapply power and check to see if the section is now working. If power to that section is incorrect or the main regulator has the correct voltage on the "IN" side and no output there is a solder bridge somewhere on the board. Look for solder joints that have slopped onto their neighbors' pads or onto the power traces or ground planes.

Transmitter adjustments and alignments

Frequencies for video and audio are set by program keys and should be checked, the first time, anyway, to verify that you have understood the programming sequence. This is easily done using a spectrum analyzer with no video or audio inputs applied to the board, or a frequency counter can be used if it can be set to "peak detect" the signal. Audio frequencies can also be checked using an oscilloscope.

Video input level (VR300)

This potentiometer (pot) sets the deviation (the width) of the video signal. It should be adjusted with no signals applied to the audio inputs and VR101/VR201 set to minimum. Using a calibrated receiver (a receiver with known ATV characteristics and settings) the video input level should be set such that the video received is in color with no "bloom" (too much signal), or is not "dingy" (not enough signal). A spectrum analyzer will verify the total deviation at approximately 8 MHz. The *ARRL Radio Handbook* has suggestions on how to set video deviation.

Video mix level (VR101, VR201)

Subcarriers are a tradeoff. They rob power from the carrier—the video—to support their life. The adjustment of VR101/VR201 creates the balance between these two signals. Using a calibrated receiver, adjust until sound is heard clearly with no video damage. Play around; see what too much audio does to the video (tearing, lines of white dots), or not enough audio (I can't hear you, but you look great). Adjust the first subcarrier (the one closest to the carrier and lowest in frequency) first. If you are using the second subcarrier (most applications won't but it's there for stereo or controls) set it according to your receiver specifications for second subcarriers. Verify that the video signal remains good and audio is clear. The first subcarrier should be set approximately 10 dB down from the peak of the video signal and the second subcarrier approximately 10 dB down from the first subcarrier (this is a very good time to have a spectrum analyzer to visualize the relationship between signals). Bessel null calculations for subcarrier power levels and deviation in relation to carriers can also be used to determine empirically the best settings for each subcarrier.

Audio input levels (VR100, VR200)

The deviation of the audio signal should be set by (once again) using a calibrated receiver. This control with a normal 1V p-p signal will be set "wide open." For audio levels above 1V p-p, such as an amplified microphone, this control should be adjusted to bring the signal back to 1V p-p. "Hot" audio sources will cause the video to "tear" due to over-deviation of the audio signal.

Author's note: Boards, parts kits, and "mostly assembled" kits should be available by the time this article is published. Information on pricing and availability will be posted on the HATS Web page at [http://www.stevens.com/hats]. E-mail inquiries can be sent to [kc5awj@stevens.com] or [n5jxo@stevens.com]. Please send SASE for complete parts list.

HOUSTON-TENNECO
MARATHON 1995
Walk for Healthier Babies
TO THE EDGE OF SPACE
To the edge of space...

Photo E. T-shirt and hat collection from activities supported by HATS since 1994. Not shown is shirt from 1994 Tenneco Marathon—it wore out.

MultiMode

BayPac™ NEW

SITOR A/B
ARQ/FEC
BAUDOT
PACKET
NAVTEX
FAX 480
AMTOR
WEFAX
SYNOP
ASCII
RTTY
SSTV
CW
More...

BP-2 Packet Only $49.95
BP-2M MultiMode $69.95
+ $5 Shipping & Handling

The best little packet modem just got better! Building on the tradition of the BP-1 Packet Modem, we are very proud to announce the BP-2 and BP-2M. The BP-2 is a new and improved version of our famous BP-1, while the BP-2M expands your horizons even further with MultiMode operation! So, whether you have been waiting to automate your CW, checkout AMTOR or just copy Weather Fax - Now is the time for you to jump in and join in all the fun!

Tigertronics INCORPORATED

Call Today! 1-800-8BAYPAC
800-822-9722 (541) 474-6700 Fax 474-6703
World Wide Web: http://www.tigertronics.com

VISA MasterCard

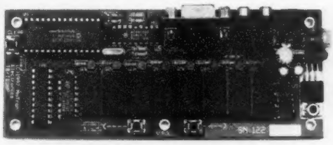
Tigertronics, Inc. 400 Daily Ln. P.O. Box 5210 Grants Pass, OR 97527

CIRCLE 269 ON READER SERVICE CARD

Motron Electronics
310 Garfield St Suite 4
PO Box 2748
Eugene, Oregon 97402
http://www.motron.com

New DTMF Decoder

$79.00
plus shipping



The ToneLogger™

DTMF Decoder Display Board with ASCII Serial Output decodes all 16 DTMF digits and features a large 8-digit LED display, an amplified audio output, jumper selectable Normal and High-speed decoding, and an ASCII serial output at 9600 baud. The 56 character memory is viewed, without loss of data, by scrolling either left or right. Although a computer is not required, the serial ASCII output allows for automatic logging of decoded number groups. Logging software for both DOS and Windows environments is included with each ToneLogger™ purchase. The NEW ToneLogger™ is 2-1/4" x 6" and requires 9 VDC at a minimum of 150 ma current.

ToneLogger™	Assembled & Tested PCB	$79.00
CAB-3	Audio & Computer Cables	20.00
PMK-1	Plastic Mounting Kit	15.00
PS-9/2	9 VDC @ 200 ma AC Adaptor	10.00

Visa, MasterCard, American Express, and Discover/Novus accepted.
COD $5 (Cash or Money Order only) S/H: $8 USA; $11 Canada; $16 Foreign

Orders: (800) 338-9058
Info: (541) 687-2118 Fax: (541) 687-2492

CIRCLE 248 ON READER SERVICE CARD

Explorers, Adventurers, and Experts

*How would **you** rule on this?*

Henry B. Ruh KB9FO
3 N. Court Street
Crown Point IN 46307
[http://www.stevens.com/atvq]

Since October 1996, I have received notice from seven ham stores that have closed their doors. If this continues, we could be down to AES and HRO by the end of the year. Seventy-year stalwart Henry Radio in Los Angeles, home to Tempo rigs and the famous Henry line of HF amps (4K-2 and 6N2 and a 3004 currently reside in my shack) closed their doors. I spoke with Ted Henry, Sr., who remarked that it was not an easy decision, but there just weren't enough hams buying gear anymore.

Now that is in Los Angeles, the most ham-populated part of the country, with Jun's and several HRO stores still operating. All told, over twenty ham stores closed their doors in 1996 and the first few months of 1997. Everyone is citing a slowdown in ham buying. All the vendors are saying the "newbies" buy an HT or a mobile rig and that ends their ham radio activity. Few are getting into higher grade licenses, and even fewer are buying big HF rigs. I am told even many of the codeless techs are selling their gear and quitting ham radio.

There are almost no new Novice licenses being issued. Not surprising. Most higher grade licenses are upgrades from pre-no-code hams. How does this affect us? With fewer ham stores, there are fewer places to sell retail copies of ham magazines, and fewer places for people to discover ham radio. So ham radio is in a continuing downward spiral with no end in sight.

This is not a new phenomenon. Like those of us who have been around a while, I remember Doc's Radio Supply (W9HJS: Hairy, Juicy Sandwiches) on Milwaukee Avenue in Chicago, a few blocks from Howard Electronics, and a genuine junk shop. There you could buy hardware or parts by the pound. I bought my first SWL receiver at Doc's, an SX99, and later a 101A. As a kid I would take the bus to Allied Electronics on Western Avenue, home of Knight Kit (remember the R-55 and T-90?). On the east coast there was Lafayette Radio, on Jericho Turnpike on Long Island. And most of us remember Heathkit and the Benton Harbor lunch boxes! A chain of Olson stores sold parts in little bags: "Kit of three SW101 switches, 99¢!"

I worked in two of the stores while in high school, taking home a cool $100 a week (back when the minimum wage was $1.10) and getting a hefty 20% discount, which helped stock my test equipment and parts boxes. I had the time to build all sorts of neat stuff from the pages of *Electronics Illustrated, Popular Electronics,* and others. I remember building a 2m regen receiver (two tubes) and a four-tube (6AQ5 final), 160m AM Tx. Five amazing watts RF output into a random long wire! I used a car radio with a retuned LO for Rx and lots of other stuff.

I have sat and thought about how, in my ham life, I have purchased over 300 radios over the years. Most were from companies that no longer exist: National, Drake, Swan, SBE, Heath, Trio (now Kenwood), Hallicrafters, B&W, Multi-Eimac, Regency, Genave, Gonset, Hammarlund, Clegg, Polycom, Allied/Knight, Lafayette. The common thread among all of these rigs was that they were *fun* radios. You could put in various mods to make them "better" or extend their range. (The Clegg FM27 was originally a 1MHz-coverage 2m rig. Another Michigan ham and I modified them for two, and then later 4MHz of range! Imagine, going from an HR-2 6-channel rig, or a slew of modified Motorola/GE/RCA/Link stuff, to a rig that covered the whole band!) My, and others', early repeaters were usually modified stuff, Motorola G strips and Sensicon As, T-43GGVs, and T-44s. Back then, if you were in radio, you were in *your* radio ... a lot!

No wonder there is little time/incentive to play with ham radio. We're all tinkering with the Internet, Web pages, and URLs. So I got to thinking. Last October (1996), I filed a 14-page Petition for Rule Making with the FCC. No RM yet. What is it?

It's a proposal to change the nature of how we do ham radio licensing. Ham radio has changed severely. The old incentive for tinkering, building, and operating has mostly disappeared along with the ham stores, parts houses, Heathkits, and manufacturers. The time competitor for technical people is now the computer/Internet. Why struggle to make one contact in Hamburg with a couple grand worth of radios/antennas, when you can check into a chat room filled with people from Hamburg for the cost of a local call? But we still do things like WAS, DXCC, county hunters, fox hunters, and contests. There are still those who pound brass because they *want* to. There are still lots of nets and there are still the 2% of hams who experiment, build, tinker, and play with more than FM and SSB.

So let us change from a helter-skelter system of license classes which have little meaning for today's ham, to a more simple one that offers more and can offer accomplishment. No more boring tests, no more grinding out hundreds of hours of CW tapes. *Let's change from a test-oriented license system to an achievement-oriented license system.* Those familiar with Scouts or professional accreditation or pilot license requirements will recognize this idea right away. If you get *N* merit badges, you become an Eagle Scout. *N* hours and you are a private pilot; another series with an instructor and more hours and you get commercial/instrument; more experience and you qualify for ATP. Well, why not a ham radio version of "merit badges" ... WAS, WAZ, DXCC, etc.?

And what's with these names: Technician, Novice, Extra, General, Advanced? My proposal is based on three steps: Explorer, Adventurer, Expert. Who wouldn't want to claim to be a Ham Radio Expert, and has the FCC paper to prove it? Got your ego working yet?

The entry license, Explorer Class, would be just that. Explore ham radio. Not a few narrow CW bands, not just VHF/UHF FM, but the whole range. HF, VHF, UHF, microwave privileges, CW, SB, FM, video, spread spectrum, whatever turns your crank. Explore ham radio and find out what you *like* to do. Contests, DX, brass pounding, whatever. Not all the bands and privileges, but a good sampling, even on bands that work when the sunspots don't! A reasonable test on the rules, safety, and operating to get you going. Now you can do more than buy a 2m HT and act like a licensed CBer. Get on HF and work a little DX, do some OSCAR, fiddle with TV, SSTV, 160m. Get to experience a broad range of activities and areas to develop knowledge (self-learning) and experience. More than knowing the Q code for FM repeaters.

Now, along the way, earn your WAS, or a CW proficiency certificate, go to hamfests, and read some magazines. This is called continuing education. Take in a seminar from the local ham club on new rules or antenna/RF safety. Gain more knowledge. Have fun while you're at it. When you get enough points in "merit badges," turn in your chips and get the Adventurer Class license.

With Adventurer, you get full privileges and full power, only a few areas out of your realm. But now you can get DXCC, WAZ, 5-band WAS, work some major contests, write for magazines, maybe teach some new hams stuff, integrate your computer with your ham stuff, build a repeater, and enjoy the adventure of ham radio. Along the way, collect some QSL cards. After a while, you will have accumulated more "merit badges" to get to 400 points, and can turn in your chips for the ham radio Expert Class license. Now you are Mr. Know-It-All and have the wallpaper to prove it.

Your ham license actually stands for *accomplishment*. You actually *did* something besides study an ARRL Q&A license guide to upgrade. Your incentive to operate is based on your desire to do things, and to upgrade to a greater range of activities and interests becomes an outgrowth of your personal growth. No more one-trick ponies. You won't be able to brag that you got your Extra and never plugged in a soldering iron.

Now, this is not for everyone. So let's grandfather those who want to stay where they are. They can renew their current licenses until they die. We won't reduce their privileges as the ARRL Incentive Licensing system did. But you can't upgrade to another "old" license class. If you want to upgrade, it will be to a new license. Just meet the new criteria. In other words, get out there and *do* something. Get a feeling of accomplishment. Turn that county hunter certificate or SMIRK certificate or Sweepstakes score into something worthwhile: a higher-grade license/callsign.

The emphasis would be on *operating/learning/accomplishment* on the air. QSL cards will fill the mailboxes. Ham magazines will flourish with new readers and writers, who will want more and have a reason to buy/build more equipment, and the VEs will be busy checking certificates rather than test scores.

The point will be that there is a huge pool of activities that will accrue "points" toward your upgrade. If you want to pound brass, your 35 wpm ARRL certificate will count, if you don't choose another area ... high contest scores, author an article, get your DXCC, WAS, etc., work 3cm, or 160m, and get the QSLs to prove it. *You choose which criteria* you collect to get enough points to upgrade. There would be *no* mandatory areas except safety and regulations, which could be satisfied by attending a one day seminar at a ham club, hamfest, or community college. Your mailing labels for five years of ham magazines could be proof of continuing education.

Get the idea? We have to change the nature of ham radio to compete with other time interests. We can do that by encouraging *operating*, not book/brass study. Besides, operating is the *fun* part of ham radio anyway—so let's encourage it!

There is the question of who determines how many points or merit badges. Answer: the VEC joint committee. Each ham radio organization that wants its operating certificates considered submits the criteria for earning the certificate to the VECJC, which determines how many points it is worth.

Determined how, you ask? The whole point is that each "evidence" of operating has some value. The point value should be assigned by the difficulty and breadth of experience each represents. Thus a WAS has *X* value, a DXCC has *Y* value. There is always someone who will raise the question, "I got my WAS by using a voltaic pile and a frog's leg to work the key, so it should be worth more." Well, you had better have the frog's leg and there had better be calluses on it that match the knob of the key! Sorry, but just because you could create a unique circumstance in which to achieve the WAS (or whatever), you don't give it any additional value.

However, if the WAS was for 50 states on only 2m and only from OSCAR, versus a bunch of HF contacts on four bands with some 6m and 2m stuff thrown in, there is a difference. The first gets the plain vanilla five points, the second gets seven or eight. Why? Because the first represents only one operating mode, and patience. The second represents (likely) several modes and several propagation experiences and therefore has more breadth to it. It gets the extra points because of the additional modes and propagation methods: five points for WAS, and two to three of the five points for operating seven or more bands, or for working seven or more modes. Keep in mind this is just an illustration, not necessarily the final say-so on how many points for any particular operation. The VEs can design the system and select what and how much.

Now, some may comment negatively that this "forces you to do things." Not any more than the rules now "force" you to study like crazy to upgrade. The difference is that with the new system you would choose a menu of activities that interests *you*. There would be no mandatory areas except safety. And, as now, if you do not want to work CW, you would not have to—you could do any of the other menu items possible to demonstrate achievement and personal growth.

If you don't want to grow, then don't do anything! If you don't want to upgrade, you don't have to. But why did you get into ham radio if you are not going to get involved in many areas and experience new things? Isn't that the main purpose of ham radio, to improve the knowledge of the license holder?

WIIFM?

If we are all operating more, it should be more fun for all of us. If more participate in any area of ham radio, that should make that area more fun. If we all learn more and experiment more, who knows where that will lead!

Maybe some of us will be inspired enough to buy a new radio, maybe some will buy a new antenna, or dare I say ... home-brew a rig or antenna! Maybe WAS or WAZ will be more exciting if there is more than one active ham in a county, zone, or state on a particular band. It's amazing how 6m will open from the midwest to Mobile, Alabama, and yet there'll be not one signal from Pensacola, Florida! Maybe more active hams will get 6m, or 220, or 1296, active on more than contest days!

Maybe the packet users will finally start using high speed time multiplex backbone links! Maybe trunking or other modern communication systems will arrive.

Or even still, maybe one ham will finally work his 50th state and qualify for WAS. Maybe there would be enough interest that clubs would begin to grow! And lastly, maybe there would be enough interest that a ham store could stay in business in Chicago! And instead of scrawny ham magazines with 50% filler and 50% ads, we would have 300+-page issues as they do in Japan, filled with lots of interesting things to do, to build, to enjoy!

We need to do one more thing—and we have already started. There are a lot of ham Web pages on the Internet. These are great starting places for those who stumble over them. Let's do it one better. Let's tie the ham Web pages to each other (as some have) and let's advertise, on the Web and elsewhere, the *fun* stuff of ham radio ... not, "The Tennessee Valley Indians Home page is located at HTTP:\\www.TVI.com," but put key words in the title so search engines *find* us. How about Rare Contact With Aliens (DX), Interactive Television (SSTV and ATV), Antique Radios (tube rigs etc.), Radical Rabbit Ears (antennas), Cure Spectrum Spreading ...

Get your imagination going and let's introduce ham radio to those who are looking for the next challenge. And yes, you can tie the Internet into your local repeater so that you can HT from LA to London to Sydney. Do it with video, too!

Here is my petition. It proposes to reduce the number of license classes to three, to be called Explorer, Adventurer and Expert. It proposes to grandfather all existing licensees' privileges, to allow a phase-in of the new licenses and privileges; it proposes allowing those holding a current amateur radio service license to either continue their present class and privileges or to adopt, through meeting the criteria listed for each, a new license class and privilege set. This petition proposes the continuation of the Volunteer Examination system so as to not add to the Commission's administrative burden.

Basis for changes

It has long been held by a great many hams and non-hams that the incentive licensing structure, initiated by the ARRL and implemented in the rules more than three decades ago, has not achieved its intended purpose; it is often blamed for the demise of manufacturers and electronics stores from the outflows of hams and the failure to attract new hams. The system depends on the individual passing a series of exams in order to attain a higher class license and more extensive operating privileges. The system also failed to recognize, at the time of implementation, the license status and privileges of existing license holders, and removed privileges from certain license classes, sparking ire and debate which lasts to this day.

The Commission currently issues licenses based upon examination. These exams serve as a gateway and include questions for which the individual cannot have prior experience to gain the knowledge, but must rely on Q&A license books and classes. The use of memorizable Q&A books such as those published by the ARRL, Bash, Ameco, and others created controversy and debate. Later, other learning aids were published which provided text presentations to teach actual theory of operation, rules and technical topics. However, the exams can still be passed by simple rote memorization of Q & A guides.

The incentive licensing system was also supposed to encourage the individual to achieve a higher class of license. When the number of individuals attempting to upgrade was disappointing, additional incentives were added, to wit: "better" callsigns (i.e., a 2x2 vs. a 2x3), vanity callsigns (for Extra class or for those with 25 years or more).

The fatal flaw in this system is that the individual has little direct knowledge of what the additional privileges may offer, since the individual is prohibited from operating certain modes and certain bands until the effort to learn from class and exam stage is passed. There is also lack of value to each level of the license structure since each level can be accomplished by only passing an exam of rote knowledge and makes no effort to encourage operation and learning by doing, which would add intrinsic value. I would compare this to telling a person that strawberries and asparagus are both equally delicious, but that they cannot have either until they first pass an exam on fruits and vegetables, and the exam only covers the biological necessities for growing them. The value of the goal is unknown, and therefore the value of the effort to pass the test is unknown. Until you taste strawberries and asparagus you can't judge the value and personal desire to have more.

Further, although there has been an influx in new license holders, few of these are expanding their horizons into other areas of ham radio, i.e., upgrading, to become more proficient and knowledgeable. Indeed, we might say we have created a handie-talkie generation, with little incentive to go beyond the use of the local narrowband FM repeater usage to discover the many other areas which offer fun, rewarding experiences, personal growth and achievements.

The basis for the proposed license system is experience and achievement. Only an initial written exam is required; although a written exam in certain areas is retained, it is replaced in most part by technical knowledge and operating experience with some credit for continuing education. The incentives are expanded privilege and callsigns of choice, but with the added value that the license and callsign stand for actual *achievement*, not memorization of a Q&A book. The exam portion would cover only those areas where experience cannot be easily obtained, such as electrical and RF safety, to minimize the risk of dealing with these everyday hazards. If the saying, "Experience is the best teacher" is true, then we need to encourage experience, through encouragement of operation and building, and related means, to achieve the goals of the basis and purpose of amateur radio, to provide a pool of technically competent individuals, to encourage education and good operating skills.

License specifics: the Explorer class license

The purpose of this license is to allow the individual sufficient operating privileges to get a sampling of nearly all areas of ham radio, vs. the narrowly-defined experiences possible as a Novice or Technician or Technician-plus license holder. By experiencing a larger variety of operating modes and bands than those allowed the Novice and Technician class holder, the Explorer license holder would be able to achieve a much higher level of understanding, new interests, and self-motivation to go farther in the hobby. The tangible rewards would be certificates of achievement in various areas, meaningful personal value to the license held, and callsign and additional operating privileges for completion of the license requirements.

The Adventurer class license

The purpose is to allow the individual additional operating mode and band privileges in order to achieve proficiency in all modes and all propagation conditions experienced in ham radio. The class could be compared to the General and Advanced class of license, wherein the holder accesses all modes and all bands, albeit not all frequencies on all bands. The tangible rewards would be certificates of achievement in various areas, value of the license held (since it stands for achievement, not Q&A test passing) and additional operational privileges for completion of the license requirements.

The Expert class license

This would represent the highest level of operating achievement and experience. It would encompass all bands, modes and frequencies as the Extra class license now does. A person could not, as I have heard some Extra class holders brag, "Get an Extra without ever touching a soldering iron." The requirements include both operating achievement and technical experience. The tangible rewards include certificates of achievement, preferential callsigns, and full operating privileges.

Examinations and procedures

The examination process would cover only those areas for which direct experience would be an issue of public safety and interference with other services or within the amateur service. The additional license requirements are all based upon completion of experience and operating elements. These other elements cannot be achieved through a Q&A book, as they require actual on-air operation and validation and technical

ALL ELECTRONICS
CORPORATION

Ultrabright LED

PAINFULLY BRIGHT RED LED
2500 to 4000 mcd @ 20 ma. These T 1 3/4 (5 mm diameter) red LEDs are significantly brighter than conventional LEDs. At close range, they are painful to look at. They are great for attention getting displays that can be seen from a distance. Water clear in off-state.
CAT # LED-42 **2 for $1.20**
10 for $ 5.00 • 100 for $ 45.00
1000 for $ 400.00

Twist-On F-56 Connector
Twist-on co-ax connector for RG-6 cable. **CAT #FTO-56R**
100 for $15.00
500 for $50.00 • 1000 for $70.00

410 UF, 300 Volt Photoflash Cap
Rubycon # 1A2304A
0.7" dia. X 1.7" long. Right angle PC or solder leads on 0.25" centers.
$2.00 each **CAT# PPC-410**
10 for $18.50 • 200 for $320.00

5 amp Solid State Relay
C.P. CLARE / Theta J # JTA2405-3
Compact, TTL compatible, optically isolated solid state relay for loads up to 5 amps @ 240 vac. 0.8" x 0.82" x 0.56" high epoxy block with a 1.4" long metal mounting flange. 1.19" mounting centers. 0.062" dia. x 0.175" high pins. Input: 4 - 8 Vdc
CAT# SSRLY-2405
$6.00 each 10 for $55.00

ORDER TOLL FREE
1-800-826-5432
CHARGE ORDERS to Visa, Mastercard, American Express or Discover

TERMS: NO MINIMUM ORDER. Shipping and handling for the 48 continental U.S.A. $5.00 per order. All others including AK, HI, PR or Canada must pay full shipping. All orders delivered in CALIFORNIA must include local state sales tax. Quantities Limited. NO COD. Prices subject to change without notice.

CALL, WRITE
FAX or E-MAIL
for our FREE
96 Page
CATALOG
Outside the U.S.A. send $3.00 postage.

MAIL ORDERS TO:
ALL ELECTRONICS
CORPORATION
P.O. Box 567
Van Nuys, CA 91408
FAX (818)781-2653
e-mail allcorp@allcorp.com
internet - http://www.allcorp.com/

achievement, achievable only through activities that are related to, but not a part of, direct on-air communication. It is the emphasis on *experience*, not rote knowledge, that makes this license system different from the current license system. Further, in order to accommodate some variation in interests and opportunity posed by personal ability, location, or other circumstances, the list of license requirements is much like a college degree program, where there are mandatory areas and optional areas.

The list of achievements provided herein is not meant to be all-inclusive nor exclusive. It is intended to be representative, and not either final nor prejudicial toward options which may be suggested by others who might comment on this proposal.

Examination and validation of the experiential portion of the license would follow the general VEC program in existence today. Individuals wanting to upgrade would present their proofs of achievement to a VEC, which would verify the achievement, and pass/fail grade the application. It would then follow the current procedures for grant and issuance of a license and callsign.

Recognizing that some individuals may have preference for different areas of concentration of their interests, or may be limited by physical constraints, the license requirements should be balanced so that a higher license grade can be achieved through the reasonable attempts of the applicant. Further, sufficient time is allowed to compensate for individual lifestyle circumstances, and other real-life concerns which can affect opportunity and ability to achieve, and yet still allow the realization of the goals of both national interest and individual interest.

For example, it would be unreasonable to require a person to operate on 160 meters, since many people cannot erect a suitable antenna because of urban living quarters, but could operate the 3cm band due to close proximity of other hams, whereas a rural resident who can operate on 160 meters could gain achievement and experience on this band, yet not be able to operate on the 3cm band because of lack of nearby population. This is not to say that the urban person cannot operate 160, it would simply be more difficult, or require more than a reasonable attempt to do so. Likewise, the rural resident could operate 3cm, by portable or mobile operation in a more populated area, but would it be reasonable for a person living in a remote part of Alaska to do so?

The individual would choose, from the selection, those items that s/he feels s/he can achieve in a reasonable manner, as defined by the individual, and present the summary of achievements to meet the criteria for upgrading.

License criteria

The purpose of graduated license classes is to ensure public and private safety, compliance with the Commission's rules, and, to some extent, differentiate between various levels of expertise, rewarding those having earned additional expertise with additional privileges.

Since the goal of public and personal safety, compliance with rules, and not causing interference is applicable to any licensed operation, it can be met at the initial stage of license. Therefore it is proposed that a question pool, as currently used, be adopted, with areas of topics which address the following:

Electrical safety: Harmful or lethal aspects of electricity; safety procedures; interlocks; discharge of power supplies; disconnection of devices; harmful or lethal aspects of RF and microwave energy (non-ionizing radiation); standards of exposure; harmful or lethal aspects of antennas and erection; controlled and uncontrolled environments; hazards of portable and mobile operation. Interference with other devices (pacemakers) and other areas may be suggested.

Compliance examples: Frequencies allocated and allowed; modes of transmission; technical consideration of modulation in various modes (spurs, artifacts of overmodulation/deviation); interference avoidance and other areas currently examined or as may be suggested by others. This is currently addressed by the question pool, but may need to be expanded in topical areas.

Operational examples: Since some knowledge of operating practices and courtesy is necessary before operation, a question pool which covers this area is necessary, to avoid inadvertent interference with established communication patterns and conventions, and allow acclimation to and acceptance by current operators and operations. Currently the question pools include specific operating methods and techniques for CW, SSB, HF, VHF, packet, digital and visual modes, band plans and repeater operations of voice and non-voice signals.

The remainder of the license criteria would be met by certificate of achievement in various areas. Since the initial license applicant cannot have prior experience, only the written portion of the exam would be required, as it is now for the Technician class license. The Adventurer and Expert class upgrades would only require proof of achievement in various areas, and a refresher course (review).

License privileges

The license holder must have opportunity to achieve growth and experience in a broad list of categories, allowing the ham to attain the necessary knowledge and skills for the next higher level. To meet this goal the following list of privileges is proposed for each of the three classes of license. Achievement of proficiency in each area (and alternate areas discussed later) is used to gain a higher license.

Explorer class license privileges

•Callsign: 2x3, 3x3, or 3x4 format or distinctive prefix (e.g., WN, WNN, NAA, etc.).

•CW operation on subbands of 80, 40, 30, 15, 10m.

•SSB operation on 25kHz of 2 HF bands, 40 and 15m (or those selected by commenters or the Commission).

•SSB operation on subband of 13cm, and all frequencies on 9cm and above.

•SSTV operation on 50kHz of the 10m band and on VHF frequencies allowed (below).

•FM voice operation on 2m above 146.00MHz, all of 1-1/4 meters, 33cm and above 9cm.

•Video operation on 13cm and 23cm or above.

•Digital operations on subbands (packet, RTTY, etc.) 6m, on 1-1/4 meters, and 13 cm and above.

•Spread spectrum operation on 13cm and above.

•May not be a repeater owner/operator/trustee (may use a repeater, but not be a control operator).

•May *not* be VE.

This allows exposure to all general-use modes, access to all propagation modes, and operating circumstances of HF, VHF, UHF and microwave.

License term: 10 years, renewable once for an additional five years. This provides a reasonable time for achievement of proficiency and experience to meet the criteria for the next class of license (below) in a controlled environment, where interference potential is minimized. Enough contact is allowed with higher class licensees on various bands and modes to gain knowledge from experience, yet the license is restrictive enough to encourage a desire for more privileges.

Adventurer class license privileges

Experience in most areas having been achieved, this class license would allow full privileges in all bands and all modes except for those reserved for Expert class. It follows the general concepts of the current General and Advanced class license.

•Modes: all currently permitted by General/Advanced class.

•Frequencies: all currently permitted by General/Advanced class.

•May build/operate/trustee repeaters.

•May serve as VE.

•Callsign pool: same as current Advanced class.

•License term: 20 years, renewal once for additional 20 years.

[Note: Petitioner is not opposed to lifetime or other term periods. However, 40 years should be more than enough to cover the life span of interest or achieve the criteria for the next higher (Expert) license class. The goal is to have all hams at the Expert level after a reasonable time period. With 15 years at Explorer and 40 at Adventurer, this allows 55 years to achieve the highest level. Starting at age 10, age 65 should be considered reasonable. For those who simply have no desire to enrich themselves, we may decide to either continue to renew, or *require* advancement. This is an area sure to draw comments.]

Expert class license privileges

•Modes: all.

•Frequencies: all.

•May build/operate/trustee repeaters.

•May serve as VE.

•Callsign pool: same as current Extra.

•License term: life.

License criteria

This proposed license system encourages learning through experience, and is presented as a guide for specific criteria of achievement.

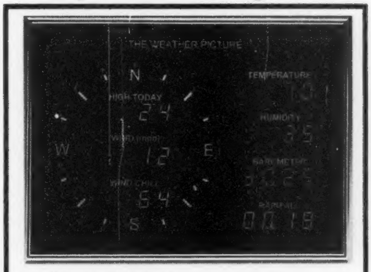
Achievement can be demonstrated in several ways. Passing an exam is the traditional method, but this can be done by rote memorization of questions and responses. In order to encourage operating and life experience as tools for learning and development, the criteria for a license should be based upon *doing*, rather than testing. There are a number of recognizable operating achievements today. These include certificates for WAS (worked all states), DXCC (worked 100 countries), or for various contact multiples, i.e., certificates for having worked X number of stations in a particular mode or particular band. It is proposed that these certificates, issued by bonafide amateur radio publications and organizations, form the basis for the license upgrade criteria. Since there are numerous areas of interest and opportunity, it is proposed that all the applicable operating awards be seen as a pool. Achievement of a certain combination or "points" assigned to each certificate would constitute proof of operating proficiency. In addition, points could be awarded for certain ham-related activities, which prove knowledge or exposure to information. These additional areas include such activities as having a technical article published, writing a computer program, building/publishing information on equipment, operating during specific events such as Field Day, or VHF contests (log submissions). Participating in public demonstrations using portable/mobile equipment, CW speed and accuracy certificates, participation in public service, attendance and completion of various ham classes as may be established by the VEC or other educational enterprises. Other criteria as well may be established.

The criteria for each license are to be based upon a point system. Passage of an exam may be a part of the overall point pool, and could be a substitute for some but not most of the experience criteria.

CODEMASTER V
0-20WPM in 90 Days
Guaranteed!
Codemaster V is the *only* computer-based **Morse code training system** that guarantees RESULTS! Whether you're a beginner or want to break the 30wpm barrier, it will take you as far as you want to go, and it's fun!
Only $29.95
Codemaster V has a wide variety of training and practice routines, trial exams, interactive arcade game, and much more. CM5 can use multiple Morse alphabets including foreign characters, and it's endorsed for military training! For any IBM compatible PC. S./H $5.00 (in US). Credit card orders toll free!
Milestone Technologies, Inc.
3140 S Peoria Unit K-156 Aurora, CO 80014
(303)752-3382 sales@mtechnologies.com
www.mtechnologies.com/mthome
800-238-8205
CIRCLE 136 on READER SERVICE CARD

160-10 G5RV QuickKits™
created by AntennasWest Box 50062-S, Provo, UT 84605
Fast & Easy to Build
• Fail-Safe visual instructions
• No measuring or cutting
• Everything included
• Finish antenna in minutes
Quality Components
• Presoldered Silver Fittings
• Kinkproof QuietFlex wire
• Fully insulated, wx sealed, no-corrode, low noise design
Tune All Bands incl WARC
• Double Size G5RV 204 ft 160-10 Dipole $59.95
• Full Size G5RV 102 ft 80-10 Dipole $39.95
• Half Size G5RV 51 ft 40-10 Dipole $29.95
• Quarter Size G5RV 26 ft 20-10 Dipole $24.95
• ReadyMade 102 ft G5RV $50.00
• ReadyMade 51 ft G5RV/2 $40.00
• 200' Dacron 250# line $11.95
Add $5 P&H
Want Plans, Patterns, Data? Order TechNote #124-D $6.95 ppd USA
Order Hot-Line: 1-800-926-7373
CIRCLE 116 ON READER SERVICE CARD

NEW for ham radio operators!



Size shown: 15 1/4" x 11 1/4"
Put the weather on your wall
Framed in elegant solid teak or brushed aluminum, The Weather Picture® gives you up-to-the-second data in large 0.8" red numerals you can easily read from across the room. Merely couple The Weather Picture to any compatible ULTIMETER® Weather Station* and select which of 56 weather values will be displayed. It's the picture-perfect way to keep tabs on fast-changing *local* weather data such as wind speed and direction, wind chill, barometric pressure, temperature, humidity, highs, lows and more.
The Weather Picture is a valuable addition to any home, office, workplace, marina or lodge. Available in two frame sizes, with prices starting as low as $139. For details, please phone toll-free, fax, or write—or visit our Web Site to see and try our ULTIMETER Weather Stations.
*Compatible weather stations from $239. Others from $179.
1-800-USA-PEET
or 732-531-4615 FAX: 732-517-0669
www:peetbros.com
©PEET BROS COMPANY
1308-7097 Doris Ave., Ocean, NJ 07712

Criteria pool

The following list is not to be considered all-inclusive or -exclusive. This list should not be considered an endorsement, nor absence from this list be considered a lack of endorsement of any organization, publication or group. These were chosen simply as widely recognized examples, or icons of the type of achievements to be considered in this proposed license system.

Explorer class license criteria

Passing an exam of 100 questions, with a grade of 70 or more, covering all aspects of ham radio currently covered by the Novice and Technician question pools, with 10 questions in each of the following required areas.

One point for each correct answer:
Public safety, Personal safety, Antenna safety, RF safety, Interference, Regulations, VHF operating, HF operating, FCC regulations, General electronics knowledge.

Five points:
Subscription to at least two ham radio magazines, one of general interest and one of specialized interest.

70 or more points is a passing grade.
Verification by VE: correct answers of the exam questions; subscription labels from publications.

[Note how this implies that the person will gain knowledge from reading about ham activity/construction, etc., as a substitute for a small portion of the necessary exam points. Thus the license holder is exposed to educational material on an immediate and continuing basis (a magazine subscription) and allows for credit for this exposure (in part) towards successfully meeting the criteria (70 points) to obtain the license. This also places some emphasis on classroom or learned rote Q&A and some emphasis on personal experience which meets the stated goals.]

***Renewal criteria:* achievement of 70% or more of the next license class.**

This is to ensure that earnest effort is made towards a higher class license, but that effort may have been limited by personal circumstance, too varied to be considered individually (i.e., military service, family obligations, illness, etc.). Presentation of any combination of criteria to achieve 70% of the passing criteria—70% of 70%, roughly 50% of the next level's exam—would be evidence that effort had been made and an extension would be reasonable.

The time period selected, 10 years, should be considered reasonable; it is the same as current license periods.

Adventurer class license criteria

The entry level license proposed allows experience to be gained in all major areas of ham radio and operating experience in nearly all modes of modulation and under all major propagation methods. It is therefore proposed that the following pool of criteria be used to achieve the next level of license and privileges. Again, I wish to emphasize that the criteria listed are recognizable icons, and are not an endorsement of nor a prejudice for or against any organization or publication.

HF Operation:

Possible criteria and possible verification method by VE. Verification methods are not repeated to avoid redundancy.

20 points for any of the following (minimum 2, 40 points):
•Proof of 2000 contacts on a minimum of six HF bands using a minimum of CW, SSB and a third mode (QSLs).
•Holder of WAS certificate.
•Holder of DXCC certificate.
•Holder of WAZ certificate.
•Placed among top 100 in major HF contest (sponsor's published list).
•Operated Field Day with more than 500 contacts (QSLs).
•Operated portable or mobile with 100 or more verified contacts (QSLs).
•Holder of other recognized HF certificate of achievement equivalent to above.

VHF/UHF/Microwave Operation:
20 points for any of the following (minimum 2, 40 points):
•Proof of 2,000 contacts on at least four bands above 50MHz, using a minimum of four modulation modes.
•Worked 30 or more states on VHF or above.
•Worked 30 or more countries on VHF or above.
•Placed among top 100 in major VHF and above contest.
•Operated Field Day with more than 250 contacts on VHF and above.
•Operated portable or mobile with 100 or more verified contacts.
•Holder of other recognized VHF and above certificate equivalent to above.

Operating Proficiency:
10 points: CW speed in excess of 20 wpm.
10 points: More than 200 countries worked using not fewer than 4 HF and 1 VHF band(s).
10 points: Publication of operating article in any recognized ham publication.
10 points: Publication of a technical article (or computer program) in any recognized ham publication.
10 points: Publication of a build-it project in any recognized ham publication.
10 points: Any recognized certificate of operating proficiency.

General experience and knowledge:
Modes: Proof of operation in each of the following:
20 points:
Each 25 or more verifiable contacts in each of the following modes (5 points per mode, minimum 4 modes):
•OSCAR
•ATV
•Packet or other digital mode
•RTTY (FSK/AFSK)
•SSTV
•FAX
•VHF DX greater than 250 miles (any mode, no repeater operation) (50-1000MHz)
•VHF DX greater than 100 miles (any mode, no repeater operation) (above 1000MHz)

Extended areas:
5 points: Subscription to two or more general interest and two or more special interest ham radio publications (publications may be foreign or domestic) for 2 or more years each (continuing education).
5 points: Instructor of a ham radio class, more than 25 total sessions (club newsletter, copy of signature on VE exams).
5 points: Featured in a public service story in any recognized publication (as the person doing the public service).

5 points: Regular participation in SkyWarn or similar activity (letter from net control).

5 points: Regular participation in ham club activities (officer, director, committee person, club newsletter).

5 points: Attendance at 25 or more hamfests or 20 or more ARRL state or national conventions (ticket stubs).

5 points: Certified VE.

2 points: Repeater trustee (holder of repeater license).

5 points: Attendance and completion of a ham radio safety refresher course.

10 points: Staff member or office holder in a national ham radio publication or organization.

Passing criteria: Minimums:

40 points HF

40 points VHF

30 points Operating Proficiency

40 points General Experience and Knowledge

Expert class license criteria

This license class represents the highest standard of ham radio operation. The person holding this should be knowledgeable in nearly all areas of ham radio, and be recognized as a leader.

HF Operation:

Possible criteria and possible verification method by VE. Verification methods are not repeated to avoid redundancy.

20 points for any of the following (minimum 5):

•Proof of 2,000 contacts on a minimum of 6 HF bands using a minimum of CW, SSB and a third mode (QSLs).

•Holder of WAS certificate.

•Holder of DXCC certificate.

•Holder of WAZ certificate.

•Placed among top 100 in major HF contest (sponsor's published list).

•Operated Field Day with more than 500 contacts (QSLs).

•Operated portable or mobile with 100 or more verified contacts (QSLs).

•Holder of other recognized HF certificate of achievement equivalent to above.

VHF/UHF/Microwave Operation:

20 points for any of the following (minimum 5):

•Proof of 2,000 contacts on at least 4 bands above 50MHz, using a minimum of four modulation modes.

•Worked 30 or more states on VHF or above.

•Worked 30 or more countries on VHF or above.

•Placed among top 100 in major VHF and above contest.

•Operated Field Day with more than 250 contacts on VHF and above.

•Operated portable or mobile with 100 or more verified contacts.

•Holder of other recognized VHF and above certificate equivalent to above.

Operating Proficiency (minimum 4):

10 points: CW speed in excess of 30 wpm.

10 points: More than 200 countries worked using not fewer than 4 HF and 1 VHF band(s).

10 points: Publication of operating article in any recognized ham publication.

10 points: Publication of a technical article (may be a computer program) in any recognized ham publication.

10 points: Publication of a build-it project in any recognized ham publication.

10 points: Any recognized certificate of significant operating proficiency (e.g., DXCC honor roll, top 25 in a major HF or VHF contest).

General experience and knowledge:

Modes: Proof of operation in each of the following modes:

30 points each 100 or more verifiable contacts in each mode (5 points per mode, minimum 6 modes):

•OSCAR

•ATV

•Packet or other digital mode

•RTTY (FSK/AFSK)

•SSTV

•FAX

•VHF DX greater than 250 miles (any mode no repeater operation) (50-1000MHz)

•VHF DX greater than 100 miles (any mode, no repeater operation) (above 1000MHz)

Extended areas (minimum 45 points):

5 points: Subscription to two or more general interest and two or more special interest ham radio publications (publications may be foreign or domestic) for 5 or more years each.

15 points: Instructor of a ham radio class, more than 25 total sessions. (club newsletter, copy of signature on VE exams).

Handheld Repeater Controller

Spectrum Electronic Products introduces the world's first handheld repeater controller. No larger than most handheld radios, the **HRC-10** converts a single or dual-band radio into a full featured simplex or duplex repeater system. Key features of the **HRC-10** include voice IDer, DTMF Control and programming, hang and time-out timers, Digital Voice Operated Squelch (DVOS™), telemetry tones, and private voice mail slot. **$299**

http://www.spectrum-usa.com

800-566-2788 - fax 408-336-9461

CIRCLE 69 ON READER SERVICE CARD

Pico J

Pico-J rolls up and hides in his 4-ounce pocket-sized holder, waiting like the Genie in a bottle till you need full-quieting signal pouch.

Call him forth and his glistening black weather sealed lines reveal a sleek end-fed halfwave antenna ready to hang anywhere. Suspend in the apartment closet or patio doorway. Attach **Pico-J** to window glass or curtain rod. He needs no radials for broadband low-angle omni halfwave gain.

Carry **Pico-J** with you for emergencies. Hang in the motel when on the road. He improves range, boosts reception, saves batteries.

Pico-J comes ready for work with 72" isolated coaxial feedline and gold pin BNC. Typical edge-to-edge SWR under 1.2:1. Hand-crafted in the U.S.A.

Info $1
Box 50062-D
Provo, UT
84605

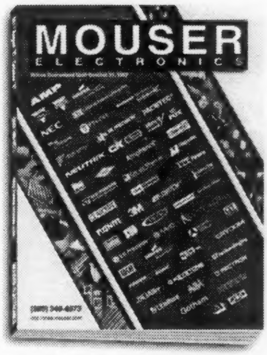
Models
2 Meters
440MH
Dual Band add $6

Antennas West
Order Hotline
801-373-8425

19.95

CIRCLE 89 ON READER SERVICE CARD

ELECTRONIC COMPONENTS



Call for your *FREE* 356 page catalog TODAY!

- 69,000+ Products
- 130+ Manufacturers
- Same Day Shipping
- No Minimum Order

800-992-9943

817-483-6828 Fax: 817-483-0931
www.mouser.com catalog@mouser.com

958 North Main St., Mansfield, TX 76063

CIRCLE 64 ON READER SERVICE CARD

5 points: Featured in a public service story in any recognized publication (as the person doing the public service).

5 points: Regular participation in Sky Warn or similar activity (letter from net control).

5 points: Regular participation in ham club activities (officer, director, committee person) (club newsletter).

5 points: Attendance at 50 or more hamfests or 25 or more ARRL state or national conventions (ticket stubs).

15 points: Certified VE.

5 points: Attendance at and completion of a ham radio safety refresher course.

10 points: Regular instruction of a ham radio safety course.

10 points: Editorial staff member or office holder in a national ham radio publication or organization.

5 points: Editor for 1 year or more, club newsletter or special interest newsletter.

5 points: Club or national officer or official 1 or more years.

Passing criteria:

100 points HF

100 points VHF

40 points Operating Proficiency

30 points General Experience and Knowledge

45 points Extended areas

VE role

To eliminate added administrative load for the Commission, the license application would follow the current VE system. Applicant's license application certificates (proof of experience) would be examined by the local VE committee. In the event of a dispute over the value or validity, the VE decision would be arbitrated by the sponsoring VE organization. Guidelines listing the multitude of certificates available as "recognized" would be generated by the sponsoring VE groups, who would agree to not exclude or include certificates, on the basis of issuing organizations to which they are affiliated which are not so recognized by the other sponsoring VE groups. [For example: A certificate from the ARRL, which is recognized by ARRL for license purposes, could not be rejected by others; likewise, certificates recognized by other VE sponsors could not be rejected by ARRL VEs.]

Any non-certificate sponsor may apply to a sponsoring VE group to be recognized, or may be presented by the applicant for consideration by the VEs.

Verification of operational criteria, through the use of QSL cards or letters confirming contacts, shall be limited to the existence and possession of the QSL card. Published lists of contest participants and their scores shall be verification of such criteria. Other publications may be used to verify other criteria, such as class attendance logs, ticket stubs bearing name and call letters and an attendance stamp from the sponsoring group, as is used by professional organizations to verify participation and attendance for professional certification.

Any dispute not so resolved would be presented to the FCC for final resolution as a simple ALJ administrative matter.

Again keep in mind that the criteria listed here are not all inclusive nor meant to serve as anything more than to illustrate how the license system would be based upon experience and achievement, rather than simple test memorization.

Specific rules changes requested:

The specific rules changes to implement the proposed license system are as follows:

1. There shall be a grandfathering and continuation of all present license holders of all privileges and licenses currently held, until such time as the licensee expires, upgrades to a new license grade of the new series, or the license is otherwise expired, terminated or revoked.
2. There shall be, as of the effective date of these rules, three classes of license for the Amateur Radio Service. The classes of license shall be: Explorer, Adventurer, Expert.
3. The VEC sponsoring shall select and establish exam and certification criteria, based upon the concept of learned knowledge and operating experience. Such selection criteria shall be made without regard to the sponsoring organization established certification processes.

The license criteria for the Explorer class license shall be:

Passing an exam of 100 questions, with a grade of 70 or more, covering all aspects of ham radio currently covered by the Novice and Technician question pools, with 10 questions in each of the following required areas.

One point for each correct answer:

Public safety, Personal safety, Antenna safety, RF safety, Interference, Regulations, VHF operating, HF operating, FCC regulations, General electronics knowledge.

Five points:

Subscription to at least two ham radio magazines, one of general interest and one of specialized interest.

Achievement of 70 or more points is a passing grade.

The license criteria for the Adventurer class license shall be:

The accumulation of points necessary to achieve the proof of experience necessary to ensure understanding of HF, VHF, general electronic knowledge of safety, HF and VHF operation, and the technical parameters of the various modulation modes permitted to the amateur radio service, to allow operation without undue risk to public or personal safety and unreasonable interference to other users and modes. The VEC sponsoring organizations will select, define and decide those criteria necessary to meet this goal.

The license criteria for the Expert class license shall be:

The accumulation of points necessary to achieve the proof of experience necessary to ensure understanding of all propagation modes, all rules, regulations and operating criteria, all modulation technical consideration, and continued sponsorship of education of lesser licensees and public safety and service.

The Commission will adopt as specific rules those certifications, and proofs selected by the VECs which meet the goals and criteria for each license class.

In addition, the FCC will institute the licensing of all existing repeater stations with a distinctive callsign to ensure that such repeaters are sponsored, built and operated by the appropriate class licensee.

No new licenses will be granted in the classes: Novice, Technician, General, Advanced, or Extra, after the new license system begins. Each such class of license shall expire completely when the last valid license currently held expires, including such renewals as may be granted for the existing license holder.

Other changes will be made as necessary for the adoption of the new system of license.

The license class names were also chosen for appeal, and to be descriptive of the privileges allowed. Explorer certainly sounds more impressive than Novice or Code-free Technician, and points to the license holder being allowed to explore ham radio in many areas. Likewise Adventurer was chosen, as the privileges allow many adventures in ham radio, and it sounds better than General or Advanced. Expert is more descriptive than Extra, and denotes superior knowledge and experience.

About the Author

Henry Ruh KB9FO has been licensed since 1969, and has been active on all bands and all modes 160-10GHz; served as a ham club president; produced and distributed PSAs on radio and TV to promote ham radio; appeared on many radio and TV programs to promote ham radio; testified before and successfully petitioned the FCC to change rules; built/operated repeaters on several bands and multiple modes; DXed on HF, VHF, and UHF; authored articles in every ham magazine; participated in and served as executive secretary of the ham radio working group for 1980 WARC; and allowed hamfests to be held on his own farm. He has received numerous achievement and public service awards for ham radio; operates from his home, car, and plane; has provided ham classes on his own broadcast radio station, and lots more. He is the Director of Engineering for a network-owned Chicago TV station and has over 30 years in broadcasting.

Amplifiers, ATV Down Converters & Hard to Find Parts

LINEAR AMPLIFIERS

HF Amplifiers
PC board and complete parts list for HF amplifiers described in the **Motorola Application Notes and Engineering Bulletins:**

AN779H	(20W)
AN779L	(20W)
AN 762	(140W)
EB63	(140W)
AR305	(300W)
AN 758	(300W)
AR313	(300W)
EB27A	(300W)
EB104	(600W)
AR347	(1000W)

2 Meter Amplifiers (144-148 MHz)
(Kit or Wired and Tested)
35W - Model 335A, $79.95/$109.95
75W - Model 875A, $119.95/$159.95

440-450 MHz Amplifiers
(SSB-FM-ATV)
100W - Model KEB 67, $159.95

ATV Down Converters
(Kit or Wired and Tested)
Model ATV-3 (420-450)
(Ga AS - FET)
$49.95/$69.95
Model ATV-4 (902-926)
(GaAS - FET)
$59.95/$79.95

HARD TO FIND PARTS

- **RF Power Transistors**
- **Broadband HF Transformers**
- **Chip Caps** - Kemet/ATC
- **Metalclad Mica Caps** - Unelco/Semco
- **ARCO/SPRAGUE** Trimmer Capacitors

We can get you virtually any RF transistor!
Call us for "strange" hard to find parts!

DIGITAL FREQUENCY READOUT
For older analog transceivers
TK-1 (Wired and Tested)$149.95

For detailed information and prices, call or write for a our free catalog!

ADDITIONAL ITEMS
Heat Sink Material
Model 99 Heat Sink (6.5" x 12" x 1.6"), $24.00
CHS-8 Copper Spreader (8 "x 6" x 3/8"), $24.00
Low Pass Filters (up to 300W) for harmonics
Specify 10M, 15M, 20M, 40M, 80M or 160M
HF Splitters and Combiners up to 2KW

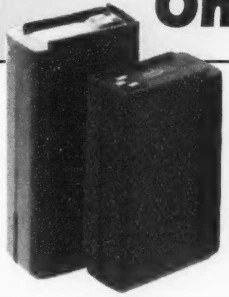
Add $4.50 for shipping and handling

VISA

CCI Communication Concepts Inc.
508 Millstone Drive • Beavercreek, Ohio 45434-5840
Phone: (937)426-8600 • Fax (937)429-3811
E Mail: cci.dayton@pobox.com

CIRCLE 99 ON READER SERVICE CARD

"Charge Nearly Any NiCd and NiMH with One Charger!"



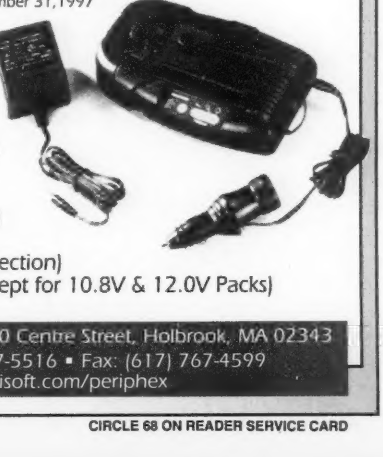
$40⁰⁰ SPECIAL

NiCd			NiMH		
EBP-24S	7.2	1200ma NiCd	BP-84M	7.2	1300ma NiMH
FNB-4SL	12	800ma NiCd	FNB-25M	7.2	900ma NiMH
PB25S/26S	8.4	1200ma NiCd	FNB-41M	9.6	900ma NiMH
PB-7S	7.2	1200ma NiCd	PB-13SM	7.2	1300ma NiMH

Above NiCD battery packs are warranted for 12 months from date of purchase.

Above NiMH battery packs are warranted for 6 months from date of purchase.

PERIPHEX
REPLACEMENT BATTERIES
Policies and prices subject to change without notice.
Offer expires December 31,1997



- For: Communications, Laptop, Camcorders & Many Other Applications
- Charges 4.8V, 6.0V, 7.2V, 8.4V, 9.6V, 10.8V, 12.0 Volt Packs
- Chemistries:
  Nickel Cadmium (Ni-Cd)
  Nickel Metal Hydride (NiMh)
- Discharges (Conditions)
- Rapid Charges (with Polarity Protection)
- Can be used in your Vehicle (Except for 10.8V & 12.0V Packs)

Advanced Battery Systems, Inc., 300 Centre Street, Holbrook, MA 02343
(800) 634-8132 • (617) 767-5516 • Fax: (617) 767-4599
http://home.navisoft.com/periphex

CIRCLE 68 ON READER SERVICE CARD

The New Emergency Alert System

Don't tune out that emergency broadcast test just because the Cold War's over!

Steven B. Johnston WD8DAS
3350 Oakham Drive
York PA 17402
[johnston@blazenet.net]

In 1994, the Federal Communications Commission finalized the characteristics of a communications system to replace the Emergency Broadcast System. This system, known as the Emergency Alert System, offers improved reliability and increased message capability. In 1995, the EAS began to be phased into operation.

Head for the bomb shelter, kids!

In 1951, President Truman established CONELRAD (Control of Electromagnetic Radiation) as the first national emergency alerting system. CONELRAD required AM broadcast stations to switch to 640 or 1240 kHz during an emergency alert to prevent enemy missiles and bombers from using their signals as target homing beacons. To activate CONELRAD alert receivers, the stations turned their transmitters on and off. CONELRAD was intended as an important part of civil defense in case of national-level emergencies such as enemy attack.

In 1963, President Kennedy established the Emergency Broadcast System (EBS) and allowed stations to remain on their assigned frequencies during a national emergency. The late 1960s and early '70s saw the development of a two-tone audio alert signal to replace the CONELRAD on/off signals. In 1976, the FCC, FEMA, and NOAA/NWS endorsed the use of EBS in state and local emergencies as well, opening the way for an alert system for severe weather and other regional emergencies.

The Emergency Broadcast System

The EBS was an analog transmission system. In tests and activations, an audible, 22-second-long, two-tone signal was used to catch the listener's ear, as well as trigger special alert receivers in broadcast stations, hospitals, schools, or any other sensitive locations. The tones were followed by a voice announcement of the test, or the nature of the emergency, what locations were affected, and instructions for the public.

EBS radio and TV stations were grouped by geographical region, and linked together to form a chain of stations. For example, a station in a state capital was designated the primary station for its region, as well as feeding the key stations in other regions, which in turn fed the stations in their areas. Emergency Broadcast System equipment was manually tested on the air once a week by individual stations, and the chains of stations were tested together periodically (timing varies according to state plans). Activations of the EBS for emergencies could be requested by local officials, the National Weather Service, station personnel, or other designated sources. The request arrived by teletype, telephone, two-way radio, or via the "daisy chain" of broadcast stations.

The EBS had several drawbacks. The system relied on each broadcaster's conscientiousness to alert the next station in the chain. If a station operator decided to forget about it, or the equipment failed, the next station down the chain did not receive the alert message and could not inform their listeners or the other stations.

Even when EBS worked properly, the length of time for a message to travel the chain could result in an announcement too late to be helpful to the public. In addition, the lengthy two-tone signals used for weekly tests desensitized the public—they often tuned to another station

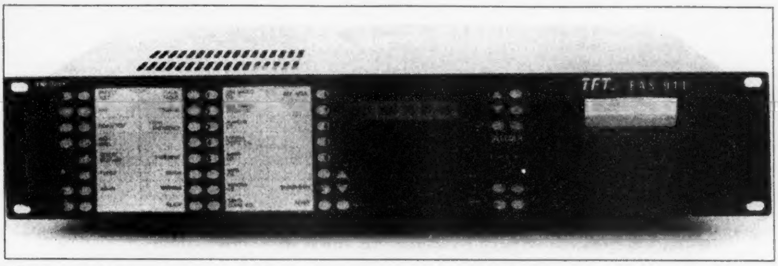


***Photo A.** EAS equipment can be programmed to sort, display, print, or forward messages based on the header codes.*

when the long tone was heard, thinking it was just another test.

The New Emergency Alert System

The FCC determined the characteristics of an improved replacement for EBS called the Emergency Alert System (EAS). This new system combines digital and analog technologies to meet the goals of greater reliability, increased listener attentiveness, and timely delivery. It will also bring the cable TV industry into the emergency alerting field.

An EAS emergency message consists of a digital signal header, a shortened two-tone EBS-style signal, an analog or digital message, and an end-of-message (EOM) signal. The means of linking emergency operation centers, broadcast stations, etc., is completely flexible, and includes the ability to interconnect the facilities using a "web" topology rather than a "daisy-chain" for greater reliability.

The digital signal is compatible with the National Weather Service WRSAME (Weather Radio Specific Area Message Encoding) system. Individual EAS sites will be tested unobtrusively each week by sending just the digital headers and EOM. Coordinated monthly tests (and activations) will consist of the headers, the two-tone signal, a voice or data message, and the EOM.

The messages can arrive by radio, telephone, TV, cable, dedicated circuit, or any other means that can pass a voice-grade signal. Each broadcast facility will be required to monitor at least two outside sources of EAS messages, forming a web to increase the chances of messages reaching their targets. A typical installation might have receivers listening to two broadcast stations, a link from the county emergency operations center, and a National Weather Service receiver.

EAS data transmissions are compatible with the National Weather Service's WRSAME system. Audio frequency-shift keying at a rate of about 520 bits per second is used, with mark at 2083.3 Hz and space at 1562.5 Hz. The content of the messages will seem rather cryptic to a monitor looking at the raw data, as they consist of an assync-preamble and ZCZC, followed by numerical codes that refer to lookup tables of originators, identifiers, event types, locations, etc. In addition, the messages are time stamped and conclude with the End-of-Message code NNNN.

EAS equipment can be programmed to sort, display, print, or forward messages based on the header codes. Stations can preset their decoders for certain types of emergencies (for example: Ignore tornado watches, accept tornado warnings), accept emergencies that apply to their coverage area, and automatically or manually put an alert on the air.

To catch the ears of listeners, the headers will be followed with the shortened two-tone EBS signal for eight seconds, then a voice message detailing the emergency for listeners. Automated stations will appreciate the End-of-Message code NNNN which can be used to trigger the next event on their station's playlist.

EAS today and tomorrow

The first steps to EAS implementation took place in 1995: The existing EBS tone encoders and decoders were modified for the shorter, eight-second, two-tone signal. In addition, many broadcasters adopted a new script for the shortened tests, which explained that a new system was on the way.

EAS equipment specifications were finalized and EAS equipment was brought to market in early 1996. The equipment is a mixture of dedicated hardware and PC-based systems. By mid- to late 1996, stations and emergency centers were buying and installing the equipment (although some inventory shortages caused late installations). Meanwhile, state and local area EAS plans to incorporate the improvements offered by EAS should have been designed, written, and accepted. The FCC deadline for full EAS operation at broadcast stations was January 1, 1997.

WANT TO LEARN CODE?

Morse Tutor Gold from G.G.T.E. is the answer for beginners and experts alike.

*Get the software the ARRL sells and uses to create practice and test tapes; and **Morse Tutor Gold** is approved for VE exams at all levels.

*Since 1987, GGTE has guided nearly 20,000 hams and prospective hams around the world through proven structured lessons and a variety of character, word and conversation drills. Straight forward menus make the process simple and fun.

*This program features easy and speedy self installation; random character drills with the characters you select; and you can create your own drills or import text files. You can type what you hear or copy by hand and see the results one line at a time. Pick the Farnsworth or the standard method; select the tone frequency most comfortable for you or select your code speed in tenths of a word per minute. For all DOS computers. You are always in command.

Certified by

Morse Tutor Gold uses your internal speaker or sound board. And, if you use a sound board **Morse Tutor Gold** supports volume control.

Sound Blaster and the Sound Blaster Compatibility Logo are trademarks of Creative Technology Ltd.

Available thru dealers, the ARRL, or send $29.95 + $4 S&H (CA residents add $2.32 tax) to: GGTE, P.O. Box 3405, Dept. MS, Newport Beach, CA 92659 Specify 5 1/4 or 3 1/2 inch disk.

CIRCLE 193 ON READER SERVICE CARD

AFFORDABLE
BOOM MIC. HEADSET
KIT: 44.95
ASSEMBLED: 64.95

State-of-the-art, noise-canceling electret Mic. with tailored response and large ear muffs reduce external noise. The Model TR-2000 is from an established aviation headset manufacturer. Prices plus S&H, less connectors. Connector-installed units available for many radios. We provide information to help you interface to nearly *any* radio. Credit card phone orders accepted.

MODEL
TR-2000

CALL NOW-TOLL FREE
1-800-634-0094
30-DAY, MONEY-BACK GUARANTEE
WARREN GREGOIRE & ASSOCIATES
229 EL PUEBLO PLACE., CLAYTON, CA 94517, USA PHONE 510-673-9393
FAX 510-673-0538 E-MAIL INFO@WARRENGREGOIRE.COM

CIRCLE 350 ON READER SERVICE CARD

Holiday of a Lifetime

Ham friends are lifelong friends—even if you're meeting them for the first time!

Roger J. Cooke G3LDI
The Old Nursery, The Drift
Swardeston, Norwich
Norfolk NR14 8LQ
UK

Recently, I was made redundant from work after 31 years as a TV/video engineer. As I was into my fifties, considered a "wrinkly" by the younger generation, and an "Old G3" by the young G7s, I looked at the employment market and promptly took early retirement.

As a result of being active on the HF bands for over 35 years, I had made lots of friends all over the world. Some had visited the UK and stayed with me in previous years and had asked that I visit them at some stage. This I had done a few years ago, when I visited friends in the USA and Canada. In 1993, I had friends from Victoria, Canada, Fred Wyatt VE7PL and his wife Jean, staying at my place again.

This was the week of our annual Norfolk AX25 Group barbecue. Also present at that barbecue was another old friend, John Bays VK2SB and his wife Mary. John used to live in Ipswich, Suffolk, and I knew him when he was G3KFX. He has been in Australia for 27 years now. During a conversation, it was suggested that I come over to Canada to visit with Fred. John also suggested that perhaps I should visit Australia. I did not take this very seriously at first, but during subsequent conversations on the air the whole trip slowly began to take shape in my mind.

I was also in contact with more friends in the USA, one of whom was my HF packet-forwarding partner, Tom Abernethy WA3TAI, from Accokeek, Maryland. He wanted me to visit with him and drive up to Dayton for the HamVention. At the same time, I was also keeping skeds with Dick Bendicksen N7ZL on OSCAR 13. Dick lives in Seattle and told me that I was not to leave him out of the schedule. The same statement was made by another friend who had stayed with me several years ago, Dave Snape VE7IM.

By this time, I could see that some time was going to be involved, but, as I was now "retired," what the heck! I decided to go for it, and thus started planning a trip I shall remember for many years to come!

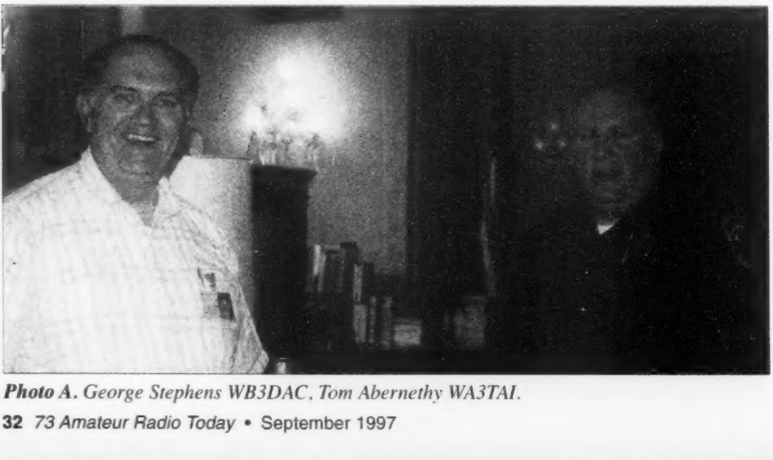


Photo A. *George Stephens WB3DAC, Tom Abernethy WA3TAI.*

First stop

My first port of call was Dulles International Airport, Washington DC. I had left Heathrow, London, early on Monday, 25th April, 1996. Nine hours later, I was met in the USA, still dressed for an English April, by Tom WA3TAI. The temperature was around 90 degrees, and I was *very* warm!! Tom drove us back to Accokeek, Maryland, taking in some of the very picturesque countryside on the way.

We spent three days looking around the local area, during which time I had a ride-along with a Washington DC police car. Tom is a policeman and was able to fix this up for me. However, I had to get up at around 4 a.m. in order to have a typical day with him. I must admit that riding around Washington DC in a high-powered police car was a real thrill, even though the most exciting event was handing out parking tickets! Tom and I visited many places of interest, including the amateur radio station at the Capitol Building, W3USS. Our host while we were there was George Stephens WB3DAC (**Photo A**).

We met up with Willy W1ZX, who runs an 432 MHz EME station and had built a 24-foot dish especially for EME. Willy runs a cool kilowatt to the dish, so the ERP is sufficient to obtain a reasonable reflection from the Moon. He is at present making a larger dish!

Tom, Willie, and I set out for Dayton, driving from Accokeek, Maryland. It was to be roughly a 12-hour trip. Traveling this distance did not seem so bad in Willie's 4x4 truck, and the roads are certainly built for comfortable long-distance motoring. Scenery along the route is superb, taking the Appalachian Highway, mountainous country mile after mile, which is quite different from the flatlands of Norfolk, UK.

Dayton is renowned for either very good or very bad weather. Unfortunately, I did not feel too comfortable with that. However, it really is worth a visit and we had a great time there, meeting with lots of amateurs and looking at all the goodies. I met with a wild bunch of amateurs who all belong to a fun club called the International Order Of Krazies (IOOK).

One colourful character comes from Waco in Texas, Hoss Karami WA5ZAI, a really nice guy. We were invited to a club meeting after Dayton. This was held at the home of Keith and Marian Farley, WA8ZWJ, in Union, Ohio. There must have been about thirty people who descended on this couple, and we had a lot of fun.

Whilst I was at the show, I decided to purchase an update for my computer system, but the company I purchased the gear from took nearly a year to deliver to Tom's address. Even then, one package never did arrive and the company involved was less than helpful. In fact, they never did answer one of my many letters to them. Tom took it upon himself to ship the gear to me, and I am indebted to him for his help. I am hoping that he is going to come to the UK and stay with me so I can repay Tom and Debbie's kindness and hospitality.

Photo B. *Bev and Dick Bendicksen N7ZL inside the Telephone Pioneers Museum, Seattle.*

One of the many sights new to me at Tom's home location, and which fascinated me, was the feeding of the hummingbirds just outside his window. I had never seen one before and they are really cute little birds! Another impression to stay with me was the number of pickup trucks in the Washington area. Everybody has one, so it seems, and a totally alien habit for an Englishman took me by complete surprise.

Tom meets up with several other local amateurs at a local eating place. Not much unusual about that, you might think, but this was at 6:00 a.m.! This is something you will *not* find in the UK, except of course, the truck drivers on the main motorways. Oh, and by the way, I have proved that it *is* true: Doughnuts *are* eaten by the police at 6:00 a.m.!

Second stop

My stay in Accokeek came to a close and I took a plane to Seattle. I have been friends with Dick and Bev Bendicksen for about 35 years now. Dick is N7ZL now, but used to be W7LPM, when we had regular contacts on RTTY. Dick and Bev first visited to present me with a RTTY confirmation in about 1960. We have been corresponding and talking on the air ever since. Dick is now retired from AT&T, as is Bev, and with the exception of a few grey hairs, nothing had much changed with either of us!

They have a very nice place overlooking Puget Sound, and a tremendous view. We went on several trips around the State of Washington, including a visit to the Boeing factory, Mount Rainier National Park, a really lovely place, and then a trip to their holiday home on Marrowstone Island. Dick has a good takeoff here and had an HF station set up, from where we sometimes QSO. Dick was mostly active on the OSCAR 13 satellite in the last ten years or so, and we often talked there, too.

Dick took me to the AT&T Telephone Pioneers Museum, where I was astounded at the amount of equipment that is installed *and* working. He, along with several other retired engineers, is heavily involved in the maintenance of the museum, and spends at least one day per week working there. I took a picture of Dick and Bev inside the museum, **Photo B**.

We spent a very interesting morning there, and Dick jokingly suggested that perhaps we could ship a British Telecom telephone box across for the museum. I made some enquiries about this when I got home, and after lengthy arrangements, telephone calls, and letters to the Prime Minister of the UK, we have now succeeded in this venture. This is a complete story in itself, but a British Red Telephone Box now resides in the museum.

One of my favourite eating places in Seattle is called Country Kitchen. It really is amazing how much cheaper

Photo C. *Author Roger Cooke G3LDI, Dave Snape VE7IM, Fred Wyatt VE7PL.*

eating out in the USA is than in the UK. We spent several happy hours in these places.

Third stop

My visit to Seattle ended too soon. I packed my bags, said my goodbyes, and took the ferry to Victoria, in Canada. This was a pleasant journey of about two to three hours, and the scenery is beautiful. Fred and Jean Wyatt met me in Victoria as I came through customs, and we drove to their home just outside Victoria. Fred VE7PL and I have a regular sked each week where we are sometimes joined by Dick N7ZL and Dave VE7IM.

Fred, just like Dick and quite a lot of other amateurs in the USA and Canada, has his station in the basement. This is something the homes in the UK rarely have, but I can see how useful they are! Needless to say, whilst I was here propagation was *not* favouring the UK, and we were not able to keep our tentative skeds with friends back in Norwich.

However, there was so much to do that time really raced by. Fred and Jean took me up to the north end of Vancouver Island to Courtney, where we stayed for a few days with Dave and Suzanne Snape. Dave is VE7IM and retired now, but he has just joined the packet revolution. His very tidy shack is a sight to be seen! We all had a very pleasant stay and a good look around the area. The three "musketeers" can be seen in **Photo C**.

On our return to Victoria, Fred and I dropped in on Larry Joe VE7DIE. Larry is the editor of the Victoria Amateur Radio Packet Association (VARPA) newsletter, a very useful and educational publication. Larry also runs VE7DIE, the local BBS.

At the end of that week, I boarded the hoverjet back to Seattle, spent another couple of days with Dick and Beverly, and then boarded a plane for Los Angeles. I changed planes there and then settled down for the 13-hour flight to Sydney, Australia.

Fourth and final visit

The flight to Sydney seemed interminable. It really is amazing to think that a plane with over 300 people and their luggage can stay up in the air that long! I finally arrived in Sydney, totally disoriented as to time or day, at 5:30 in the morning. I was met by John Bays VK2SB.

I needed several self-pinches to convince myself that I was actually in Australia, a place I'd thought I would never see. We arrived at John's home in Crows Nest, where I had a shower and some breakfast. We decided not to try to cope with any jet lag, but just to go ahead and see how I would survive. John and I therefore went for a tour of Sydney and Darling Harbour and spent the day sightseeing.

I spent the first few days with John preparing the 6-litre Mercedes car that we were to use for our trip up to the north of Queensland. We fitted an HF radio, a Kenwood TS-50, with a vertical on the rear of the car, and a 2m FM radio to use on the repeaters. We also made sure that we had plenty of changes of clothes and spares with us. In case we got stuck in the outback with no AC mains, we also packed a portable generator. As it turned out, we did not have a need to use it.

Having done all of this, John then took me out on his boat up the coast of Australia for a few days, in the company of a friend of his. We sailed as far as Pittwater and Brisbane Water, and visited several of the islands and inlets. Most evenings we were able to talk back to VE7 with superb signals from the boat, and also back to the UK, too, although propagation was not too good. Place names around this area would sound good on a DX QSL card: Coasters Retreat, Dangar Island, Refuge Bay, Acuna Beach—most of them are deserted, but provide superb places to anchor for the night. This we did, enjoying a BBQ on the deck of the boat and some very interesting walks.

Returning to Sydney, I received a telephone call from the UK telling me that my elderly mother had fallen and broken her hip. Luckily, she was in the hospital and had it replaced the same day. This was the second time for her, and at 89, it is very worrying. However, I was told there was no need to return home, but to keep in touch. Amateur radio played a very important role in this during our trip north, as propagation was not good, and relays via stations VK6WL and EA7BA were extremely helpful.

We started from Sydney, driving north along the coast road. John VK2SB drove in the mornings and I took over in the

Photo D. *Peter Hill VK2BZA in his shack.*

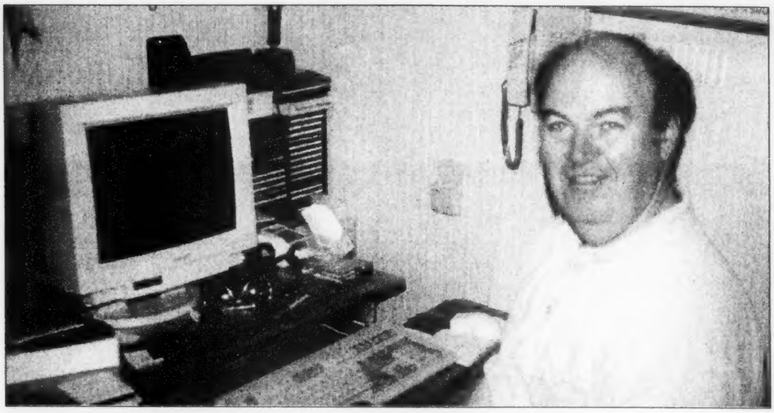


***Photo E.** Tony Lonsdale VK2DHU, author of Paket.*

afternoons. We used the two-meter radio to talk via the Terry Hills repeater as we left Sydney, speaking with Dick VK2GRA, who happened to be in the hospital after suffering a heart attack.

Our first stop was Yarrawonga, overlooking Lake McQuarrie, where we stayed with friends of John. Next day, we drove to Bonny Hills while talking with Richard VK2CHC on the way. We visited Peter VK2BZA. Peter is in his eighties now, but still very active, as you can see from the photograph in **Photo D**. He is very keen on 40 meters and has a two-element beam for that band.

We also visited VK2BZC, known locally as Doctor Paul, as he is a doctor. Paul is very keen on packet and is a member of the local packet group.

That night we also paid a visit to Tony Lonsdale VK2DHU, **Photo E**, and spent a very interesting and pleasant evening with him. Tony is the author of Paket, which is a very popular terminal program. There are about 50 amateurs around the Port McQuarrie area. Twelve are active on packet, with more coming on line. There are forwarding links both on 1200 baud and 9k6 baud, much needed amidst the vast amount of open country, where communications really is a problem. Several links rely on HF as well, distances being such that this is the only reliable method.

Next stop was Coffs Harbour. I speak regularly on HF with John VK2GJK, but by coincidence John was on holiday in the UK at the same time I was in VK-land. However, we did visit his QTH to see where he lived—among the banana plantations! We also visited Bob VK2AWA, 78 years young and also active on HF and packet (**Photo F**).

Driving further north approaching Ballina, we spoke to Gordon VK2AGE, who runs a very active HF Amtor station. We were too far away to call in, unfortunately. We then spent some time in Surfers Paradise, where interests other than amateur radio abound! Driving further north to Beenleigh, we managed to talk to the UK with the help of Alan

***Photo F.** Bob Colsell VK2AWA, 78 years young and still active on packet and HF.*

FREE!

NEW CATALOG

CALL TOLL FREE: 1-800-JAN-XTAL

Quality Crystals and Oscillators for:

AMATEUR BANDS•CB•MARINE VHF
SCANNERS•MICROPROCESSORS•PAGERS

P.O. Box 60017 • Fort Myers, Florida 33906
(941) 936-2397

JAN Crystals

CIRCLE 242 ON READER SERVICE CARD

FREE CONSTRUCTOR'S CATALOG!

RF Shielded Steel Boxes

MODEL	W x D x H in.	A*	B**
SB-1	2.1 x 1.9 x 1.0	4.65	5.50
SB-2	3.3 x 1.9 x 1.0	6.25	7.50
SB-3	4.2 x 1.9 x 1.0	9.50	11.25
SB-4	6.3 x 1.9 x 1.0	11.00	12.50
SB-5	3.3 x 2.7 x 1.1	9.75	11.50
SB-6	4.8 x 2.7 x 1.1	12.00	14.25
SB-7	6.4 x 2.7 x 1.1	13.75	16.25
SB-8	2.6 x 2.7 x .63	7.25	8.75
SB-9	3.2 x 2.7 x .63	8.50	10.00
SB-10	4.8 x 2.7 x .63	9.25	11.00
SB-11	6.3 x 2.7 x .63	11.25	13.25
FEED-THRU CAPACITORS			
FTS-1	1000pF/50VDC SOLDER	.88	.95
FTSI-1	1000pF/50VDC SCREW-IN	3.60	3.75

VISA

HOT TIN-PLATED STEEL BOXES WITH DIVIDERS; ELIMINATE SPILLOVER OF UNWANTED SIGNALS!
FEED-THRU CAPACITORS, TOO!
*MUST MENTION AD FOR DISCOUNT

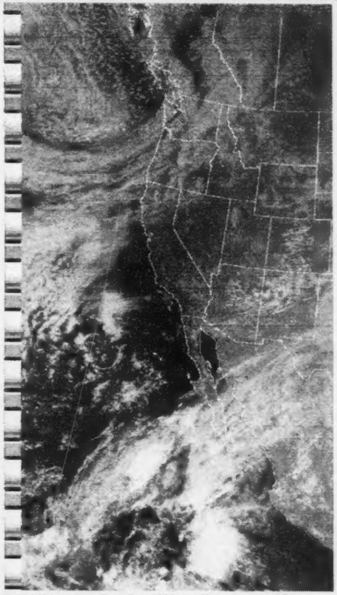
ORDER TODAY! ($30.00 MINIMUM ORDER)
PRICES INCLUDE WORLDWIDE SHIPPING!
*A = Cont. U.S., CANADA & MEXICO; **B = Rest of WORLD

SESCOM®

ORDERS 800-634-3457 ■ FAX 800-551-2749
OFFICE 702-565-3400 ■ FAX 702-565-4828
SESCOM, INC. 2100 WARD DR., HENDERSON, NV 89015
SESCOM, INC. is not responsible for inadvertent typographical errors and prices and specifications are subject to change without notice.

CIRCLE 167 ON READER SERVICE CARD

Get The Picture!



VHF Wx Satellite Decoding
Call or write for our free catalog

Software Systems Cosulting
615 S El Camino Real
San Clemente, CA 92672
Tel (714) 498-5784 Fax (714) 498-0568
www.sscorp.com

CIRCLE 250 ON READER SERVICE CARD

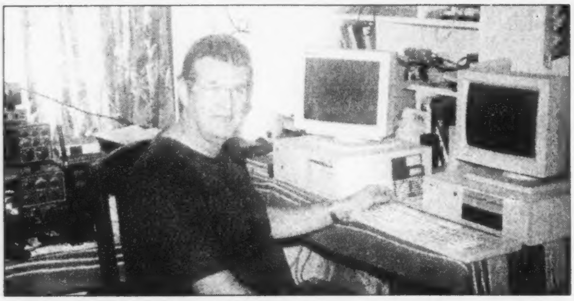


Photo G. Anske Corbett VK4CAB, who runs the BBS in Bundaberg.

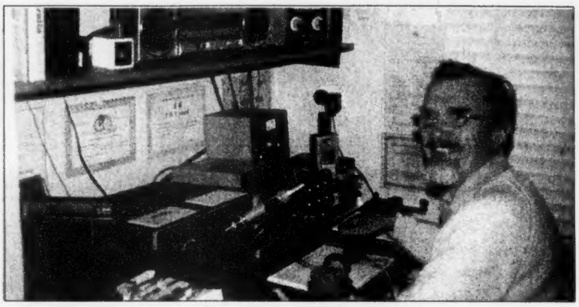


Photo I. Bill Senior VK2WS in Armidale.

Photo H. Brian Beamish VK4BBS in Brisbane.

EA7BA again, keeping tabs on my mother's progress, which thankfully was good. Propagation did not allow a direct contact, but Alan kindly helped out when he could. Ipswich was next, then to Esk, where I bought an Australian hat, with fly-chasing corks dangling around the wide brim.

Then on to Noosa Heads, Hervey Bay, and Bundaberg. Here we met Anske VK4CAB, in **Photo G**, who runs the local BBS. We then went on to Rockhampton, Marlsborough, and Airlie Beach. After this came Bowen, Inkerman, Cardwell, and finally Cairns.

We drove back via the tableland and rain forest, and after much sightseeing ended up back at Proserpine, near Airlie beach, where we met John's wife Mary at the local airport. We then hired a yacht for a week's sailing in the Whitsunday Islands in the Great Barrier Reef, an experience I shall never forget!

After this, we visited the sapphire mines near Emerald, and did lots of tourist things like visit wildlife parks. At Rockhampton, Mary flew back to Sydney. We continued our journey down the Burnett Highway, through Biloela, Eidsvold, Toowoomba, and finally to Brisbane. Here we visited Brian VK4BBS, who ran the satgate for that part of VK. Brian can be seen in **Photo H**. We spent a very pleasant evening with Brian and his wife Maureen. Brian has now passed on the job of satgate sysop, but is still very active on packet.

After this we had yet another BBQ in the Garradeen National Park, and then spent a very pleasant evening with Bill VK2WS and his wife Margaret, in Armidale, with whom we keep regular HF skeds. Bill has a super location about 3000 feet up in the mountain range where Armidale is located (**Photo I**).

After this, another day or so of driving took us back to Sydney again. We spoke with Jo Harris VK2KAA, who asked us to call and see her. Jo also had David Ramsay VK2KLX with her when we called. Jo is a committee member and David is the president of the Australian Amateur Packet Radio Association (AAPRA). Jo has a superb station, set up such that she can walk around the backs of all her gear. What a sensible idea! She also has complete records—better than just a callbook—of all VK amateurs. AAPRA is similar to VARPA in that they produce a very interesting newsletter well worth subscribing to.

Before I left Australia, I managed to talk John into buying a TNC and antenna, and got him active on packet. I even sent a few messages back home before I left.

In total, I was away for three months, six weeks of which were in Australia. Without the superb friendships forged through amateur radio, this holiday would *not* have been possible; the hospitality I received was absolutely superb, and I am indebted to all my hosts. I only hope I can return the favor some day. It just goes to show what a wonderful hobby we have—one we should cherish very dearly. The memories of this will last forever! 73

INSURANCE
for
AMATEURS
Insure all your radio and computer equipment.
(except towers and antenna)
HAMSURE
E Mail:hamsure@ameritech.net
www.ameritech.net/users/hamsure/hamsure.html
7901 Laguna Lane Orland Park, IL 60462
800-988-7702
Available only in 48 contiguous US
CIRCLE 78 ON READER SERVICE CARD

All Aluminum
Chassis Kits
Cabinet Kits
Assembled Cabinets
Slope Box Kits
UHF & VHF Antenna
Power Divider Kits
Rack Shelves
Rack Equipment
Antenna Grounding Kits
Tower Mounted Box Kits
Dipole Hangers
Other Enclosures
Small sheets Aluminum and Brass
UHF / VHF Antenna Parts
Byers Chassis Kits
Charles Byers K3IWK
5120 Harmony Grove Road • Dover, PA 17315
Phone 717 - 292-4901
Between 6PM and 9:30PM EST. Eves.
CIRCLE 222 ON READER SERVICE CARD

Walking-Stick Beam?
Hold it in your hand—it's a walking stick made of aluminum with rubber ends. But inside are all the elements of a 4 element yagi that goes together in 2 minutes. Ready for the T-Hunt. Ready to get your signal out of a hole into the repeater. No little bits to drop and get lost. Everything fits clean and tight and tough. 2meters $79, 70 cm $49. Weighs only 1 lb. Add $6 Shipping & Handling. Info $1.
AntennasWest
Box 50062-S Provo UT 84605
Order HotLine
801 373 8425
CIRCLE 324 ON READER SERVICE CARD

CornerBeam?
SWR < 1.2:1 across the band
Gain of a 15 ft Yagi
No dimension over 7 ft
40 dB Front-to Back Ratio
60° Half-power Beamwidth
Mounts directly to mast
Vertical or Horizontal Polarization
2meters $145, 220 MHz $145, 70 cm $115, Dual 146/440 $165
Weighs only 10 lbs. Add $11 Shipping & Handling. Info $1.
AntennasWest
Box 50062 Provo UT 84605
Order HotLine
801 373 8425
CIRCLE 380 ON READER SERVICE CARD

Inside MFJ's New 969

The Versa Tuner II could be for you.

Peter A. Bergman NØBLX
3517 Estate Dr. SW
Brainerd MN 56401

I had already decided that I needed a new antenna tuner before I saw the MFJ-969 Deluxe Versa Tuner II. I had been using their 949, which was doing a good job for me, but the guy I had borrowed it from wanted it back. The 969 looked good, so I ordered one.

When the new 969 arrived, it looked great. Then I did something that may seem really strange. I left the new tuner on the kitchen table, poured a cup of coffee and sat down to read the instruction manual.

The MFJ-969 is a "T"-match tuner rated at 300 W RF. It covers all bands between 160 m and 6 m. I like to work six sometimes, so having a tuner with that coverage is a real plus.

My first impression of the new Versa Tuner was, "This unit is meant to be used and to last." The finish is a really tough vinyl coating that looks great. The markings on the front panel and meter are clear and easy to read—heck, the rear panel markings are, too. Everything is held together with machine screws and threaded inserts. I like that. The 969 measures only 3.75 inches high by 10.5 inches wide by 10 inches deep (9.5 cm by 27 cm by 25 cm), but has enough heft to keep the coax from pushing it around the operating table.

Another bonus is the air-core roller inductor. The air-core construction is the same type as that used in MFJ's 989C 3 kW tuner. The inductor is firmly mounted and hard-wired to ground and the hot end. The huge contact roller rides inside the coil on a shaft rotated by the large knob on the front panel. The air-core design eliminates a number of the moving contacts present in the rolling inductor arrangement most of us have seen in the past. The turns counter is driven by an "O"-ring-type belt and the reset button is recessed so that it won't be bumped accidentally.

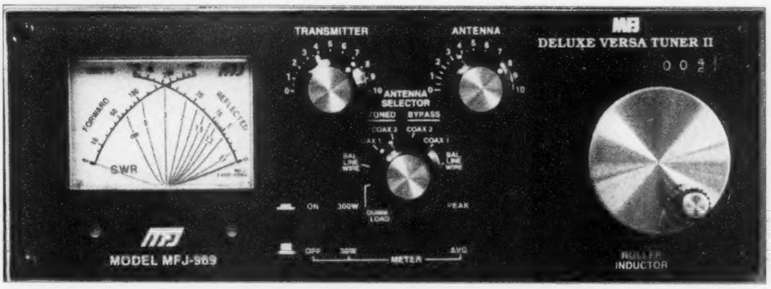


Photo A. *The well-made, easy-to-use, MFJ Deluxe Versa Tuner II.*

I also like the front panel layout. Frequently I'm able to reach up to make an adjustment without even looking at the tuner (see **Photo A**).

The Antenna Selector switch on the 969 has eight positions. This new arrangement allows the user to adjust the tuner into the internal dummy load or any of the antennas connected at the rear panel. It also allows direct connection to the dummy load or the antennas while bypassing the tuner. Rear panel connectors are provided for the transmitter, as well as for two coax-fed antennas and either a random wire or balanced line fed antenna. An internal balun is included for feeding balanced lines (see **Photo B**).

The SWR/Wattmeter is a dual-movement instrument with three scales. Forward power is read on the left scale, reflected power is read on the right scale, and standing wave ratio is read on the center scale, at the point where the needles cross. This meter has 30 W and 300 W scales and will read either peak or average power. The peak power circuitry can be operated from either an internal 9 V battery or an external source such as the optional MFJ-1312B power pack. The external source will also provide power for meter lighting.

The built-in dummy load is handy and eliminates one more thing on the operating table or to be packed and carried along on Field Day. It will dissipate the full three hundred watts for 30 seconds or 100 watts for a minute and a half. It will handle power levels of 25 watts or less continuously.

I occasionally fire up some of the tube-type gear I've collected. The built-in dummy load and the bypass to dummy load position on the antenna selector really help. The load and tune controls on the rig can be adjusted into the dummy load first. Then, a turn of the antenna selector switch routes the output to any of three antennas, either directly or through the tuner.

Before using the 969 with my rig, I decided to play with it a bit. I connected my MFJ-259 Antenna Analyzer to the tuner in place of the transceiver. To the Coax 1 and Coax 2 ports I connected a G5RV and my battered pre-WARC 40-10

Down East Microwave Inc.
Stocking K1FO design Yagi's and TELETEC Power Amps.

Transverters & Down Converters, Linear power amplifiers, Low Noise Preamps, Loop Yagi and other antennas, Power dividers, coaxial components, hybrid power modules, relays, GaAsFET, PHEMT's & FET's, MMIC's, Mixers, chip components, and other hard to find items for small signal and low noise applications.

We can interface our transverters with most radios.

Please call, write or see our web page
www.downeastmicrowave.com
for Catalog, detailed Product descriptions and interfacing details.

Down East Microwave Inc.
954 Rt. 519
Frenchtown, NJ 08825
Tel. (908) 996-3584
Fax.(908) 996-3702

See the FUN you've been missing!

Slow Scan TV

Every day more and more hams are enhancing their enjoyment of ham radio by adding images to their conversations. Join the fun!

new ***Pasokon TV*** Lite .... $30 + $3 shipping.
Pasokon TV Classic .... $200 + $5 shipping.

Absolute Value Systems
115 Stedman St. #7
Chelmsford, MA 01824-1823
(508) 250 0611

`http://www.ultranet.com/~sstv`

CIRCLE 351 ON READER SERVICE CARD

BROADCAST TRANSMITTER

The **FMS2** studio quality transmitter is FULLY crystal controlled and programmable to any FM broadcast frequency.

Unit features: ALC, 2:1 compressor, audio buffer / amplifier, pre-emphasis, roll off filter, stereo generator, digital PLL tuning, 75 MHz-125MHz bandwidth, 500mW power output and a special introductory price of only $295.00 US.

SCHEMATICS FOR UNIT $27 *CATALOG 416-243-3225*
F[illegible] 416-243-1067 *TEK [illegible] 416-243-2260*

wavemach COMMUNICATIONS

CIRCLE 245 ON READER SERVICE CARD

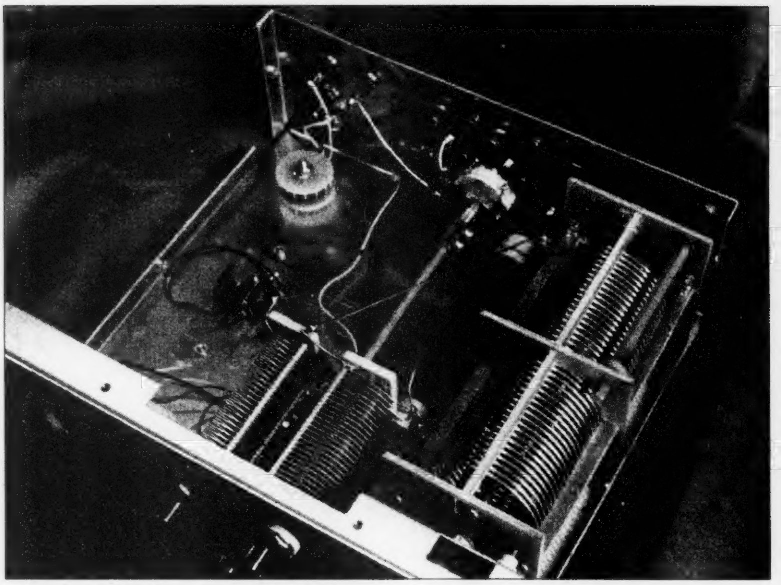


Photo B. *Inside view. The new MFJ-969 covers 160–6 m.*

trap vertical. It should not surprise anyone that I was able to get a 1:1 match anywhere from 54 MHz to 3.5 MHz on either antenna. WARC, MARS, CAP, you name it. Very easily. The old trap vertical could even be tuned on 160.

Then I decided to get cute and try to duplicate a stunt we pulled during the infamous Zoo Crew DXpedition to Winnipeg. I hooked up a 5/8-wave two-meter mobile antenna to the 969 and was able to get a good match anywhere from 54 MHz to 10 MHz. Below that things started getting flaky, but nine bands on a four-foot whip is pretty darn good. It could come in handy during an emergency.

So, what do you get with the MFJ-969? A lighted SWR/power meter that measures peak or average power from 1.8 to 54 MHz, a 300-watt HF/6-meter dummy load, a heavy-duty 4-to-1 balun, an 8-position antenna switch, and a really versatile HF/6-meter tuner. This unit will not only match dipoles, verticals, inverted vees, random wires, beams, mobile whips, and SWL antennas, but is also handy on the test bench when repairing or adjusting your rig.

MFJ is well known for their No Matter What™ warranty. Their customer technical support, available as long as you own the product, is also a big plus.

If you're looking for an antenna tuner in the 300 W class, check out the MFJ-969 Deluxe Versa Tuner II. I'm glad I did.

MFJ dealer information or the MFJ catalog is available directly from MFJ at [76206.1763@compuserve.com]; FAX (601) 323-6551; or MFJ Enterprises, Inc., Box 494, Mississippi State MS 39762, (601) 323-5869. Their toll-free order number is (800) 647-1800. Technical support is available at (800) 647-TECH(8324). 73

208-852-0830
http://www.rossdist.com

SPECIAL! Under $560^00

KENWOOD
TM-V7A
Dual-Band FM Mobile

RDC

Check Out Our Specials! We're On The Web.
Over 9050 HAM Items in Stock. All Prices Cash FOB Preston
ROSS DISTRIBUTING, 78 S. State Street, Preston, ID 83263
Hours Tue.-Fri. 9-6 • 9-2 Mondays. Closed Saturday & Sunday

CIRCLE 254 ON READER SERVICE CARD

Next Day **QSLs** ***Two-Color Rainbow Assortment***

Baraboo, Wisconsin
Sauk County
K9ZZ

Info $1

Antennas West
(801) 373-8425

Call Today & We Ship	*Next Day*	*2nd Day*	*ASAP*
100	*$29.95*	*$24.95*	*$19.95*
200	*$39.95*	*$34.95*	*$29.95*
400	*$49.95*	*$44.95*	*$39.95*
500	*$54.95*	*$49.95*	*$44.95*
1000	*$99.95*	*$89.95*	*$79.95*

All orders ppd 2nd day air/ priority mail.
For overnight air delivery add $10.
Box 50062-S, Provo, UT 84605

CIRCLE 5 ON READER SERVICE CARD

NEW PRODUCTS

Number 39 on your Feedback card

A Ham's Range Should Exceed His Grasp

Your hand-held rubber ducky will radiate poorly in your car—but if you put an MFJ UltraLite™ mag-mount antenna on your car's roof, you can greatly extend the range of your hand-held.

MFJ announces the new MFJ-1721 Two Meter UltraLite, for only $14.95, and the MFJ-1722 Two Meter/440 MHz UltraLite, priced at $18.95. Both include nine feet of coaxial cable and weigh less than two ounces. The flexible whips will fold into any briefcase, bag or glove compartment—these little dandies are meant to go everywhere *you* go!

For your nearest dealer or to order, call (800) 647-1800; FAX (601) 323-6551; or write to: MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville MS 39759.

Digital / Analog Exciter

Exciting Pages

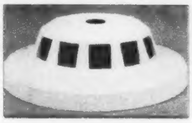
RF Neulink announces the new digital paging transmitter/exciter. The DPT series is a high performance, continuous-duty VHF paging transmitter/exciter with both digital and analog modulation capabilities. While normally utilized as an exciter stage to drive high-powered RF amplifiers in wide area paging systems, the DPT series can also be utilized as a stand-alone transmitter for local area, on-site, and in-building paging applications.

The DPT series is fully synthesized and can be easily programmed in 10 or 12.5 kHz increments via a built-in RS-232 port. Several models are available, covering the 136–174, 218–230, or 260–28 MHz frequency ranges.

For more information contact RF Neulink, 7610 Miramar Rd., San Diego CA 92126. Call (800) 233-1728 or (619) 549-6340; FAX (619) 549-6345; E-mail [rfneulink@aol.com].

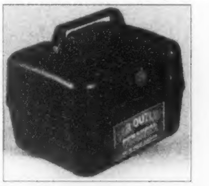
No Compromise, No Question

Svetlana Electron Devices, Inc., announces the new 3CX6000A7/YU148 power triode, a drop-in replacement for the one used in popular FM transmitters. This tube is designed with a modern mesh filament which assures a no-compromise, long-life performance. It's manufactured with high-alumina ceramic doped with chromium and molybdenum, which results in a stronger metal/ceramic chemical bond and allows higher processing temperatures than used by western manufacturers. High-temperature bake-out drives gases from internal electrodes during vacuum processing, and clean processing means long operating life. Each Svetlana 3CX6000A7 is full-power RF tested at the factory in Russia, and is backed by the strongest warranty in the industry—12,000 hours/3 years—and the time warranty doesn't begin until the tube is put into operation. Contact Svetlana at their US headquarters, 8200 S. Memorial Pkwy., Huntsville AL 35802; (205) 883-1344; FAX (205) 880-8077; or E-mail them: [sales@svetlana.com] or [engineering@svetlana.com].



Did Somebody Say *Area 51*?

No, it wasn't spotted in the sky over New Mexico. It's the Colorsentry™ SD-865C, another outer-limits-looking goodie, and the latest in the GBC "Smart Value" line. It looks like a smoke detector, but it's an inconspicuous color camera. Install it in any home or office, and it will provide high-quality surveillance with a resolution of 325 lines and a sensitivity of only .4 lux. It comes standard with a 4mm lens and includes mounting hardware and a 12VDC power supply. For more information contact CCTV Corp., 280 Huyler Street, South Hackensack NJ 07606. Phone (201) 489-9595 or (800) 221-2240; FAX (201) 489-0111.



The Name Says It All

The FAR OUTLET™ is a fully self-contained portable source of 110 volt, 60 Hz household current. The size of a lunch box and light enough to carry in one hand, it provides up to 250 watts continuous and 400 watts peak power. It'll power virtually anything that will run on household current, and with its exclusive "Digiscrub" digital filtering circuitry the FAR OUTLET's extremely low-noise AC power won't introduce discernible distortion into computers and audio devices—its power is as clean as that from a wall outlet. Recharging is as easy as plugging the FAR OUTLET into the nearest wall socket or (with the optional converter) into an automobile's cigarette lighter. Suggested retail price is under $300, so look for it where you get your cool toys.

Crystal Set Projects: 15 Radio Projects You Can Build

The Xtal Set Society proudly announces the publication of their latest book, a collection of radio projects that won a recent building contest run by the Society. Included are step-by-step instructions so you can build and design your own Xtal sets no matter what your background in electronics. The projects are of various designs and difficulty so that everyone can learn something.

Crystal Set Projects is a 6 x 9 paperback, retailing for $14.95 (plus $2.50 s&h). You can find excerpts from it, and other Xtal publications, on the Internet at [www.midnightscience.com], where you'll also find building plans for the famous Quaker Oats™ box radio, vintage magazine articles from the 1920s and 1930s, and a specialty bookstore, Midnight-Science Books.

To order *Crystal Set Projects*, send a check, money order, or your VISA/MC number to The Xtal Set Society, P.O. Box 3026, St. Louis MO 63130. Call them at (314) 725-1172; FAX them at (314) 725-7062; or E-mail them at [xtalset@midnightscience.com].

Midas Touch for Motorola Minis

Nemal Electronics International of North Miami, Florida, has introduced a coaxial adapter for use with Motorola P110 and GP300 hand-held radios. The NE9395 adapter accepts a BNC plug and adapts to the Motorola miniature 3.5 mm-type antenna connector. The adapter features a gold-plated center contact and Teflon™ insulation for optimum performance throughout the VHF and UHF spectrum, and a knurled body for ease of connection. NE9395 is a direct replacement for Motorola part number HLN9756A. For more information, contact Nemal Electronics at (305) 899-0900; FAX (305) 895-8178; E-mail [info@nemal.com].

New Simplex Full/Half Duplex Autopatch Only $144

Use it like a cellular phone

An Affordable Autopatch packed with Incredible features!!!!

Simplex Autopatch with Reapeater $193
Full/Half Duplex Autopatch $109
Other acessories also available on request

Requirements

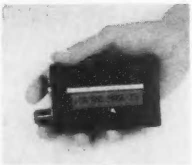
1) Telephone line
2) 12v Power Supply
3) 2 transceivers
4) A radio microphone connector that fits your transceiver

Automatic CW identifier
(automatically send call sign)
Programmable time out
(will disconnect when out of range.)
User selectable password
(Select up to 9 digits to activate autopatch)
Reverse patch
(able to page you when your phone rings)
Adjustable Volume
Easy Installation
Compact size 1.25" x 4" x 2.4"

Ultimate plus Pocket Morse Code Trainer

Learn code faster and easier
Better than code tapes
Light weight and compact
Ideal for beginners to advance

*Selectable code rates 3-33 wpm
*User friendly menu
*Plays Standard and Farnsworth
*Plays continuous fresh random code
*Selectable random character playing
*Runs 30 hours on a 9 volt battery
*Size 2 3/8 X 4.5 x 1



Only $69.99

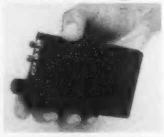
Six Modes of Operation

1) Continuous Fresh Random Code
2) Test for Copying Random Code
3) Plays Continuous New QSO or Basically a Conversation Between Two People
4) Selectable Random Code
5) Interactive Code Training
6) Playing Random Words

Deluxe Plus Pocket Morse Only $44.99
is like the Ultimate except
no LCD display

Standard Plus Only $29.99
Standard code trainer is like the Deluxe except

No internal speaker
No selectable random code



Our Pocket Morse code Trainers have more power than most PC Morse code software programs, yet can still fit in the pocket of your shirt !

Computer Aided Technology,Inc.
4525 Production Drive, Dallas, Texas 75235
Phone: 214-350-0888

Visa/MC accepted Add $10, $8 S/H,Tax if Applicable

CIRCLE 276 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 5

E. 87th, NYC 10128, ISBN 0-9643870-0-X, 185pp, 1994.

Next you might want to spring $8 for *Good Teeth - Birth to Death*, by Dr. Gerard Judd, 6615 W. Lupine, Glendale AZ 85304, 117pp, 1997. This will be one of your better reading investments, and you'll sure never drink fluoridated water again, much less poison your body with mercury.

Still another book you'll enjoy is a *Reference Guide - Total Mercury & Other Heavy Metals Detoxification Program*, from National Integrated Health Associates, 5225 Wisconsin Avenue #401, Washington DC 20015. And it's FREE!

Armed with data like this you'll know a lot more about dental amalgam than your dentist.

Making Your Hobby Pay

Yes, you can cash in on your hamming. Well, you can if you are anything but what Scott Adams calls an "induhvidual." If your imagination and motivation limitations have kept you confined to the simplest of rag chewing, with no exploration into our couple dozen satellites, slow-scan TV, the UHFs and microwaves, packet, RTTY, and the many other learning delights our hobby offers, then I guess you're not going to be interested in what you're about to read.

However, if you've shown any signs of creativity at all, you just may be able to cash in on some of the things you've done. You see, studies have shown that on the average your salary the next time you change jobs will be jumped by about $1,000 a year for every article you've had published. That puts the $100-$200 or so pittance we pay for articles to shame, but it's an awfully good reason to put on what's left of your thinking cap (if you can find it) and see what you can come up with.

You might want to write a series explaining some aspect of ham technology, like Pete Stark has been doing for newcomers to electronics and radio. Or maybe you've designed and built a gadget that would get others excited? Or thought up something truly brilliant in an antenna.

Fame and fortune can be yours if you get your word processor going and start shooting us articles. And don't forget the cliché formula to tell 'em what you're going to tell 'em, then tell 'em, and then tell 'em you told 'em. Get us interested right up front with what the benefits are going to be of reading your article. Let's see if you can pry a bunch of fat butts out of their cushy operating chairs and over to the workbench.

Maybe you've had the actual guts to modify a piece of commercial gear? Or to build an accessory?

Or perhaps you've been first in line for a new piece of gear that hasn't been reviewed yet. We'd publish a half dozen reviews every month if you'd get busy and contribute. And none of this listing of specifications—readers want to know how well it works, what benefits it provided you, and so on. If you really like it, see how many readers you can get to buy one. If you don't like it, forget the whole thing. The readers will mainly be buying equipment that's had good reviews and they'll quickly forget the stuff that doesn't get mentioned.

Please take good photos, not instant snap shots. And don't forget a disk copy so we don't have to keyboard everything again.

Now, whatcha got for me?

Gutted

In my senior year in high school I arrived in school one morning with a serious pain in the appendix area. The school nurse poked around, asking if this hurt. You bet! Within a few hours I was in a hospital with my (ugh) hair being shaved by a nurse. My main worry was that I was going to miss the Bob Hope radio show that night. In those days you spent a couple weeks in a hospital bed recovering from surgery. Lordy, what a bore.

It turned out that my dad managed to find a doctor with great big hands, and he'd had a tough job finding the appendix, so my scar was a beaut.

After two weeks in bed my digestive system had just about stopped, generating memorable constipation. Just what I needed to go with the healing incision. And then came learning to walk again.

They've long since learned to operate and get 'em up and out in a day.

Oh, I had one side effect of the operation. The anesthetic they gave me for some reason made it so I couldn't sing for a couple months. And I had been active in the Philharmonic Choir of Brooklyn, so that was also memorable.

Which brings me from 1940 to 1997 and the well-kept medical secret that appendicitis can be treated with a $50 dose of penicillin instead of the $4,500 surgery … unless the appendix has already burst, which calls for immediate removal. There's a new test for appendicitis (about $200) called FACT, for Focussed Appendicitis Computer Tomography, and it seems to be 100% accurate. It's been revealed that about 97% of appendix surgery can be avoided, and that's around 50,000 operations a year.

Well, I thought you ought to know, and who else would tell you? Certainly not your friendly doctor, who probably is unaware of all this since it hasn't been published in any of the American medical journals. You have to happen to be reading the *British Journal of Clinical Radiology*.

While I'm At It

In case you've been suckered into believing all the baloney about UVs causing deadly skin cancers, I'd like to squelch that exaggeration. Yes, the most common form of skin cancer (carcinoma) is caused by excess UVs, but these appear on the hands and face and are rarely serious. The bad guys are melanomas, which can kill. But they most often appear in areas of the skin not exposed to the sun or on those who seriously overdo

Continued on page 43

Secrets of the 1340

Inside Ten-Tec's new QRP transceiver kit.

Mike Bryce WB8VGE
P.O. Box 508
Massillon OH 44648

Ten-Tec can trace its roots back to the time when its first products were mainly kit modules. You could use them to assemble a small, direct conversion QRP transceiver. From these first modules sprang the Power Mite series, the Argonauts, and the rest—as they say—is history.

The 1340 is a single conversion superhet QRP transceiver that will operate on the most popular ham bands: 80, 40, 30 and 20 meters. It's a monobander, so you need to pick the band you want. Sorry, no SSB here—it's a CW-only rig. RF output is rated at 3.5 W into a 50-ohm load.

The controls are basic. You get the usual off/on/volume and station selector with RIT. You'll also notice the lack of an RF gain control. I'll tell you why in a few minutes.

There's ample audio to drive the internal speaker, so you don't need to hug headphones all day long. If you like headphones, no problem—the front-mounted 1/4-inch jack automatically disconnects the internal speaker. The audio is rated at 350 mW into a 4-ohm load.

The whole shebang is housed in an attractive clamshell metal housing. The 1340 has a list price of under a hundred bucks.

Signal flow

A JFET is used as a mixer to convert the incoming 7 MHz signals to an IF of 11 MHz. A double-tuned bandpass filter keeps unwanted signals from entering the mixer.

Once mixed with 4 MHz VFO energy, the result is routed through a four-pole crystal filter having a bandwidth of about 1 kHz. Instead of using a IC IF amplifier chip, Ten-Tec uses an NPN transistor set in common-base configuration.

The IF is now directed to the BFO mixer, an NE612, before going on to the audio preamplifiers and AGC amplifier. The audio power amplifier is an LM386 rated at 350 mW.

The transmitter is a simple and effective circuit. Output of the VFO is mixed to produce 7 MHz. It's filtered to remove any unwanted emissions and then passed on to the driver and the final amplifier. The 2SC2166 will easily produce 3+ watts of RF to the antenna.

The 1340 features full QSK keying with built-in sidetone. The volume of the sidetone is adjustable. The tone is set to match the incoming CW note centered in the four pole filter.

The VFO has a range of about 50 kHz and is tuned electronically by a varactor diode. The main tuning control is a 10k panel-mounted pot. During assembly you can select any 50 kHz portion of the 40m CW band. The RIT is also tuned by a varactor diode and has a range of about 1.5 kHz.

Components

The 1340 comes bundled together with all its parts divided into groups. All the resistors are in one bag, the capacitors in another, and so on. This way, you need not wade through a zillion 0.1 µF caps looking for a lone 5.2k resistor.

PHONES
VOLUME
T•KIT
ON
OFF
RIT
QRP CW TRANSCEIVER

***Photo A.** The Ten-Tec 1340 QRP transceiver.*

All those parts mount on a single Fiberglas™ PC board, about 3.5 by 5 inches, with silk-screen on the component side and solder mask on the bottom. The PC board is single-sided. It's first class, with nice wide traces and fat pads—just right for a new builder should the need arise to remove a part or two. Those micro pads on some PC boards pop off too easily.

Build in steps

Unlike some of the other kits, in which you stuff the board full of parts and then give the whole thing the smoke test, Ten-Tec has you assemble the 1340 a bit differently.

You build the 1340 in sections or, as Ten-Tec says, "phases," trying out each phase of construction before moving on to the next one. There's no need to move on to the next phase of board-stuffing if you can't get the last section to work. I also like this method, as it gives the builder a sense of satisfaction. And it sure lowers the blood pressure because you bypass the smoke test. If you do all the tests before moving on, you're just about guaranteed a working 1340 when you lay the soldering iron down.

The phases of construction begin with the easy circuits and progress into the more complex ones. The T/R switching is the first to go in, followed by the VFO. The VFO, although complex by itself, is needed to confirm operation of the filters and mixers. You continue to add on stages until you are ready to fire up the receiver. With a working receiver, you move on to the transmitter. You button up the case when you're done.

Building the 1340

I enjoy building kits, especially one as well organized as the 1340. The manual is well written, with plenty of information on what makes the section you're working on "work." There's info on troubleshooting the rig and general information on operating QRP. The manual has numerous pull-out sheets with oversized part placement guides. I especially enjoyed the anti-solder bridge overlay showing all the traces of the PC board, but without the pad holes. Every kit should have one of these!

All in all, the manual for the 1340 makes for good reading. The spiral binding allows it to lie flat on the workbench. It's full of assembly tips, such as installing the set screw into the main tuning knob so it won't get lost. Heathkit set the standard for assembly manuals. Perhaps Ten-Tec is about to up the ante with the excellence of this one. I get the feeling Ten-Tec assembled a dozen or more 1340s just for the purpose of fine-tuning the manuals to easy assembly.

Be forewarned: You'd better have on a good pair of running shoes when you start stuffing parts. That's because you'll run all over the PC board looking for the correct PC locations. You run around only in your section, but I did find I spent a lot of time looking at the enlarged overlay and smaller section maps of the board.

If you're an old-time kit builder, and start to jump into the assembly, you'll have trouble. There is no logic (that I could see) in stuffing any of the sections. On one line you're installing R15 and on the next one you're putting in R54 in the opposite corner of the section. So, you experienced builders will need to slow down and read the instructions! All the parts fit the board and there were no surprises.

I have but one complaint about the silk-screen in a place or two. In one section you're asked to install a electrolytic capacitor. Of course, we both know that these guys are to be installed correctly, as they are polarity-sensitive. However, directly above this cap's location was a plus sign on the silk-screen. This not only slowed me down, but brought me to a dead stop. It turned out the plus sign was for the power leads. But I was again slowed down because a black wire goes into the hole with the marking showing a plus sign. Hmm ... This happened to me twice while I assembled the 1340. There are no mistakes in either the manual or the silk-screen. And, as I said before, you need to take your time and read the instructions.

Final assembly

I tested as I went, and smiled all the while—until I got to the first step in the receiver. Although all seemed to be just fine, I could not hear a thing. To make matters worse, most of my test gear was still in storage and unavailable to me. All I had to test the 1340 was my Drake receiver.

I decided to move on to the final receiver sections. After I had installed the audio preamp, AGC, and other related parts, the receiver popped right up. Although I've built countless numbers of receivers, those first signals coming through one you made by hand are always sure to give you a case of the warm fuzzies! That's part of the pleasure of kit building. With a strong signal, I had ear-splitting volume, while the 1340 drew 250 mA at 13.5 V on peaks. Standby current with no signal was under 30 mA.

The transmitter came on-line without a hitch. I tweaked and peaked so my 1340 produced 4.2 W into a 50-ohm load at 13.5 V. At key-down, it required 870 mA of current to produce this amount of RF.

Of course, the 1340 features the famous Ten-Tec full break-in keying. CW is crisp with a nice note. One operator noted the CW had a musical quality to it.

Since the entire 1340 is built on one PC board, it's a simple matter to mount the board inside the supplied case and attach the necessary wires to the connectors. The 1340 uses an honest-to-goodness SO-239 RF connector. You also have the usual power, headphone, and key jacks. I'm not really thrilled about the use of an RCA phono jack for power connections, but that's just my opinion.

Odds and ends and other observations

Just like so many other home-brew QRP transceivers, the 1340 lacks a truly usable frequency display. You know you're someplace on the 40m band, but not exactly where. You have the ability to generate a frequency table by noting the log scale of the 1340. This is not so much a fault with the 1340 as it is typical within this price class of radio.

There's no RF gain control on the 1340. That's because this rig has a real, smooth-working, AGC circuit. It's nothing fancy, but it works just fine. It's really nice to monitor the band and not have to ride herd on the gain control.

I like a receiver that is wide enough to allow you to listen to the band while you're working on another project. The 1 kHz bandwidth is quite refreshing to listen to instead of those super-tight 250 Hz bandwidths some rigs use.

I was rather impressed with the stability of the VFO. Unlike some of the other rigs that use a spoonful of parts and an NE602, the 1340 has a real VFO. The VFO is varactor-tuned using a pot. The RIT is also varactor-tuned. The VFO has its own voltage source and is stable no matter what the supply voltage. The VFO is temperature-compensated, too.

On the other side of the street

I've always had a dislike for tuning a radio with a pot. Perhaps it's just me, but in time, that pot is going to get noisy and fail. The tuning is rather fast, although it's very linear. You can't turn the RIT off, so you must be sure you have the control centered. Sure would have loved to have seen a center-detent RIT control!

There are several coils you must wind for the 1340. Now, before you throw your hands up in the air, let me say it's not hard to do. In fact, if you follow the instructions, take your time, you'll not have bit of trouble. Ten-Tec made it as painless as humanly possible.

While the 1340 has a lot of parts, it's easy to assemble. Is it a kit for first-time builders? Yes, I really think so. If you've never soldered before, get someone to show you how it's done. You may need some handholding in some places, but there's nothing that should get in your way. The 1340 would be a great club project. Call Ten-Tec for details.

NEVER SAY DIE

Continued from page 40

their tanning. The result of the skin cancer panic has been the sale of billions of dollars worth of sun screen.

Your skin and eyes need exposure to the sun on a regular basis; just don't make a religion out of it. Read the books by Ott, Lieberman, and Douglass on the subject. Do your homework.

Snowballs From Heaven

Big as a house! Every day! Well, if you'd read a couple of Sir Fred Hoyle's books, like I asked you to, this science news flash would have been old hat to you. Although the estimated quantity of slush arriving from space is a surprise, astronomers Hoyle and Sandra Wickeramasinge did a very good piece of scientific detective work as reported in their *Diseases From Space* in 1979 and *Evolution From Space* in 1981. Naturally they got the usual ridicule from their compatriots for such absurd ideas.

Hoyle noticed that every now and then a new disease would hit us, and that when it did it would start simultaneously in a number of geographically separated places. And that, after a lot of investigation, led to his writing the first book. It's a fascinating detective story, too bad you haven't read it.

Next Fred and Sandra noticed that the evolutionary development of life seems to have gone on fairly predictable routes, except that every now and then a totally new life form would seemingly appear out of nowhere, with no links to explain it. They also noted that there are a number of species which seem only marginally adapted to the conditions of Earth, and have abilities which have no reason for having developed here. Further, they found that the basic life forms (seeds) could have traveled for millions to billions of years in space and still come to life when they entered a hospitable environment.

With all those tons of slush arriving every day, it seems like it would be worthwhile to send up some big garbage bags to collect some of the stuff so we can see what may be arriving along with all that water.

One more thing, with an estimated 43,000 smaller comets, some with as much as 40 tons of water, reaching Earth every day, how come the space station and astronauts haven't been hit with some giant slushees?

See page 9 of my "Guide To Books" for details about the two Hoyle books.

Moon Rocks

File this under "strange coincidences." A note from Art Bell listener Terrance O'Grady in Minnesota mentioned René's pointing out that the so-called Moon rocks were strangely similar to those found in Antarctica. He says he was part of the IGY III and IV projects (1957-59) and helped bring back to the States five crates of rocks, about 800 pounds worth—the same amount that came from the Moon. What do you want to bet those

Continued on page 47

Mr. NiCd YOUR SOURCE FOR
BATTERIES!
- AMATEUR RADIO BATTERY PACKS
- REPLACEMENT RECHARGEABLE INSERTS
- LAPTOP COMPUTER BATTERIES
- CAMCORDER BATTERY PACKS
- CELLULAR PHONE BATTERY PACKS
- SEALED LEAD-ACID BATTERIES
- O.E.M. & CUSTOM ASSEMBLY PACKS
- AUTHORIZED SANYO NiCd DISTRIBUTOR

Call or write for our free catalog!
Mr. NiCd -*E.H. Yost & Co.*
2211-D Parview Rd., Middleton, WI 53562
Phone (608) 831-3443 / Fax (608) 831-1082
DEALER INQUIRIES INVITED
CIRCLE 114 ON READER SERVICE CARD

NINE-BAND HF
ANTENNAS 100 W
NO MAST REQUIRED
ALMOST UNSEEN PLACED
ON TOP OF ROOF TILES
EMDR 1 28 ft $369 incl. Airmail
for single story home
EMDR 2 50 ft $399 incl. Airmail
for taller residence
SMALLEST WIDEBAND LOOP
EVER DESIGNED FOR 9 BANDS
CFL 2 diam. 2 1/2 ft $499 incl. Airmail
for car, mobile home, or balcony
For data or orders FAX early any day
+ 44 1 224 316 004 (Mastercard/Visa)
HATELY ANTENNA
TECHNOLOGY GM3HAT
1 Kenfield Place, Aberdeen AB15 7UW
Scotland, UK
CIRCLE 258 ON READER SERVICE CARD

WE SHIP WORLDWIDE
Barry Electronics Corp.
WORLD WIDE AMATEUR RADIO SINCE 1950
Your one source for all Radio Equipment!

For the best buys in town call:
1-800-990-2929
Los Precios Mas Bajos en Nueva York
WE SHIP WORLDWIDE!
Export orders expedited.
Special export prices.

KITTY SAYS: WE ARE OPEN 7 DAYS A WEEK
•Sat. 10-5 •Sun. 12:30-6 •M-F 9-6 Come to Barry's for the best buys in town.

WHEREVER I GO, I TAKE MY RADIO.
SPECIALIST IN RADIOS:
•BUSINESS •MARINE
•AVIATION •HAM RADIOS
•SCANNERS

MOTOROLA SP10, SP50, P110, GP300, GP350, P1225, M1225 M120, GM300, GR300 repeaters, & SM50

Radios for Business, Governments, Consulates, Embassies. Stocked and Serviced. Overseas and Domestic Orders.

ICOM
HAM, MARINE, BUSINESS AND AVIATION RADIOS
281-H, 2000-H, 2350-H,A-22, IC-77, IC-706, IC-707, IC-T2A & IC-756.
NEW F30LT/F40LT, V100

"YAESU HAM & VERTEX BUSINESS RADIOS" FT51-R, FT-8500, FT-10, FT-11, FT-2500, FT-3000, FRG-100B, FT-1000D, FT-50R, FT-5200, FT-840, FT-900AT, FT-920, VXR-5000 repeater 25 watts, VHF or UHF. Marine Mobile VXM-100.

KENWOOD
Shortwave Receivers R-10, R-100, R-7000, R-8500, R-9000
NEW — 220 MHz BUSINESS RADIOS WITH REPEATERS

Business Radios: Motorola, ICOM, Maxon, Yaesu, FTH 2008/7008, etc, Uniden, Regency, Relm
Marine ICOM: M10A, mil, etc.
Aviation ICOM: A22, A200

"TS-50S." TS-570D, TS-850S, A441A, TM-V7A, TM-942A, TR-751A, Th-235A, Kenwood Service Repair, TS140S, TS690S, TS-790A, TS950SD, TH 79A(D), TH28/48A, TM-741A, TM-733A, TM-641A, TM-742A.

•Cellular Phones •Shortwave Radios •Scanners •Best Prices

MOTOROLA RADIOS EXPORT & DOMESTIC CALL FOR PRICES

Electron Tubes
3-500z, 572B, 6JS6C, 12BY7A, & 6146B

FT-50R Yaesu

MARINE RADIOS
ICOM M7, M11, M56, M710, M810, AVIATION PORTABLE ICOM A22, MOTOROLA, TRITON, MARINE

Surveillance Devices Available

SHORTWAVE RECEIVERS STOCKED

TH-79A(D) Kenwood
FT-51R Yaesu

Save money on batteries. Call for Special Prices.

Barry's supplies all MFJ products Call us direct.

Wide selection of SW & Amateur Publications

Shortwave Receivers
Drake • Grundig • JRC • Sony
Sangean • Panasonic • Yaesu
ICOM • Lowe • Kenwood

Computer Interfaces Stocked: MFJ-1270B, MFJ-1274, MFJ-1224, Kam Plus, KPC-3, MFJ 1278T, PK-900, DRSI PRODUCTS DSP 2232

Antenna Tuners: MFJ, ICOM, KENWOOD, YAESU, VERTEX

COMMERCIAL & HAM REPEATERS STOCKED. WRITE FOR QUOTES

KANTRONICS KAM PLUS Etc.

2 Meter, 440, 220MHz Band-Pass Filters from DCI

CB Radios Stocked
148GTL, Washington, Ranger 2950-70, Antennas: Wilson, Antron, etc. Power mikes w/beeps - ECHO - SilverEagle etc.

Bird Wattmeters & Elements in Stock

MOTOROLA AUTHORIZED DEALER
KACHINA COMMUNICATIONS DEALER
AUTHORIZED DEALER
SONY
Shortwave Radios Stocked

Amplifiers- Icom, Kenwood, Yaesu, RF concepts, Mirage, TE Systems, HF/VHF/UHF, AMERITRON, etc.

ALINCO DJ-180, DJ-G5TY, etc.

Telephone Autopatch

Telephone Scramblers
Hy-Gain Towers

Overseas Telephone Systems for Rural Areas

ANTENNAS: A-S, AES, Cushcraft, Hy-Gain, Hustler, KLM, METZ, Urban, MODUBLOX, TONNA, Butternut, Multi-Band, Alpha Delta, ANLI, Antenna Specialist, Barker & Williamson, Comet, Diamond, GAP, Laresen, Etc. Watt-Meters Stocked.

BENCHER PADDLES BALUNS LOW PASS FILTERS IN STOCK

Fm & AM Broadcast Transmitters Stocked
Satellite Phones

Garmin & Magellan Global Positioning Systems

ASTRON POWER SUPPLES
Belden Wire & Cable, Int'l Wire

NEXTEL Radios-5 burough coverage in NY.

BARRY ELECTRONICS CORP., 540 BROADWAY, NY, NY 10012 (Five blocks N. of Canal St., between Spring & Prince St.) FAX 212-925-7001 Phone 212-925-7000

New York City's LARGEST STOCKING TWO WAY RADIO DEALER COMPLETE REPAIR LAB ON PREMISES
"Aqui Se Habla Espanol"
BARRY INTERNATIONAL
FAX 212-925-7001 Phone 212-925-7000
For Orders Call 1-800-990-2929

Monday-Friday 9 AM to 6 PM
Saturday 10-6 PM / Sunday 12:30-6

Subways: #6 Spring St. stop, N. or R. train to Prince St. stop F train to Houston St. stop.
Bus: Broadway bus to Prince St. stop, Path train to 9th St./6th Ave.

COMMERCIAL RADIOS STOCKED: •MOTOROLA •ICOM •MAXON •STANDARD, •YAESU •RELM etc.. We serve municipalities, businesses, Civil Defense, etc. Portables, mobiles, bases, repeaters...

SALES FINAL

e-mail: barry_electronics@compuserve.com
We stock: Alinco, Ameco, Ameritron, Antenna Specialist, ARRL, Astatic, Astron, Belden, Bencher, Bird, Butternut, CES, Cushcraft, Codan, Daiwa, Eimac, Henry Heil, Hustler, Hy-Gain, Icom, KLM, Nextel, Kantronics, Kenwood, Larsen, Maxon, MFJ, Mirage, Motorola, Nye, Palomar, RF Products, Shure, Standard, TUBES & Tube Cartons, Uniden, Yaesu, Vibroplex, Duplexers, Repeaters, Scanners, Radio

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
DEALER INQUIRIES INVITED PHONE IN ORDER & BE REIMBURSED
COMMERCIAL RADIOS STOCKED & SERVICE ON PREMISES.
EXPORT orders shipped immediately. CALL

Technical help offered upon purchase
FAX: 212-925-7001

Number 44 on your Feedback card

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the December issue, we should receive it by September 30. Provide a clear, concise summary of the essential details about your Special Event.

AUG 24

WOODSTOCK, IL The Tri-County Radio Group, Inc. will hold its Hamfest and Computer Show at the McHenry County Fairgrounds, located just north of Rt. 14 on Rt. 47, beginning at 6:30 a.m. for the flea market and 8:00 a.m. for the exhibitors. Set-up available on Saturday by appt. or 6:30 a.m. Sunday. Talk-in on 146.52 (simplex). For more information or reservations write to: *T.C.R.G., P.O. Box 3107, Skokie IL 60077-6107*; or call *Robert N9KXG, (708) 944-0500.*

AUG 31

DUBUQUE, IA The Great River ARC, Iowa Antique RC and Historical Society, and the Tri-State Computer Users Group will sponsor a Hamfest/ Radiofest/Computer Expo August 31st, 8 a.m.–2 p.m., at the Dubuque County Fairgrounds on Old Highway Rd., west of Dubuque. Features include free parking, dealers, flea market, and tailgating; with VE exams at 10 a.m. Adm. is $3 in advance, $5 at the door; 12 and under admitted free. 8' tables are $8. Talk-in on 147.84/.24. Contact *Loren Heber N0YHZ, at (319) 556-5755; Jerry Lange KB0VIK, at (319) 556-3050; or Jerry Ehlers N0NLU, at (319) 583-1016.* Write to *G.R.A.R.C., P.O. Box 546, Dubuque IA 52004-0546.*

SEPT 6

ERIE, PA The Radio Assn. of Erie PA will hold their annual Hamfest and Computer Show on Sat., Sept. 6th, 8 a.m.–2 p.m. This ARRL-sanctioned hamfest will be located at the Franklin Township Firehall near Edinboro and Albion PA. Easy access from I-79 and I-90, 6 mi. south of I-90 Exit 4; or take I-79 to Albion Exit 38, then Route 6N west for 2.5 mi., north on Route 98 for 2.8 mi. Free parking. Handicapped accessible. Adm. $4 in advance, $5 at the door. Children under 12 free. Tailgating $1 per space plus admission ticket. Setup Fri., 6 p.m.–Midnight; Sat., starting at 5:30 a.m. 8' table $8, electric $2 per table. No outside food or beverage sales permitted. Test bench available. VE Exams at 9 a.m., Franklin Center Methodist church, Route 98, 1 mi. north of the hamfest. Talk-in on 146.01/.61. Contact *Chris Robson KB3A, 4485 Kell Rd., Fairview PA 16415. Tel./Fax (814) 474-1211; E-mail [crobson@erie.net].*

SEPT 6–7

AUSTIN, MANITOBA, CANADA The Manitoba Amateur Radio Museum will host its 3rd Annual Ham Fest on the grounds of The Manitoba Agricultural Museum in Austin. For details write to *Manitoba Amateur Radio Museum, Inc., 25 Queens Crescent, Brandon, Manitoba, Canada R7B 1G1.* Remember to enclose an SASE.

LOUISVILLE, KY The Greater Louisville Hamfest/ARRL KY State Convention will be held at the Kentucky Fair & Exposition Center, all indoors. Tickets $6 for both days, Sunday $5 at the door. Send advanced ticket registration with an SASE. Mail requests for tickets and info to *P.O. Box 34444-Q, Louisville KY 40232-4444.* Commercial vendors call *(812) 948-0037, or (812) 282-7007.* For flea market spaces call *(812) 282-4898, or (502) 935-7197.* Check the Web page at *[http://www.thepoint.net/~GLHA/].*

SEPT 7

BUTLER, PA The Butler County ARA will hold its 20th annual Hamfest and Computer Show on the 7th, 8 a.m.–3 p.m., at the Butler Farm Show Grounds, Route 68 west of Butler. Adm. $5, under 12 free. Flea market tailgaters $2 per setup. Indoor vendors $15 per 8' table. Free parking. Talk-in on 147.36(+). Contact *K3LL, 1080 N. Boundary Rd. #C, Cranberry Twp. PA 16066; or call (412) 538-9491. E-mail [K3LL@nauticom.net].*

JOLIET, IL The Bolingbrook ARS will hold its annual Hamfest and Computer Show at the Inwood Recreation Center, 3000 West Jefferson St. (Rt. 52), Joliet IL, one mi. east of I-55. Tickets are $4 in advance, $5 at the gate. Setup times for indoor tables, Sat., 3 p.m.–6 p.m.; Sun. (both indoors and outdoors), 6 a.m. Gates open at 8 a.m. VE exams for all license classes 9 a.m.–noon. Walk-ins welcome. Free parking. For indoor tables, write to *BARS Hamfest Chairman Ed Weinstein WD9AYR, 7511 Walnut Ave., Woodridge IL 60517, or call (630) 759-7005.* For advance tickets, check and SASE to *BARS Hamfest '97, P.O. Box 1009, Bolingbrook IL 60440.* Please allow 10 days for processing. Talk-in on 147.33(+600 kHz); 224.54(-1.6 MHz); 146.82(-600 kHz).

SEPT 11 & 25

FT. WORTH, TX The Lockheed ARC and the Kilocycle Club will co-sponsor VE test sessions for all classes of licenses. They will be held at the Lockheed Recreation Area facility located at 2400 Bryant Irvin Rd., Ft. Worth TX, at 7 p.m. Some testing done by appointment only. For info, call *Ted Richard AB5QU at (817) 293-6745.*

SEPT 12–14

RIVERSIDE, CA The Inland Empire Council of Amateur Radio Organizations will sponsor the 1997 ARRL Southwestern Division Convention Hamcon '97. The event will be held at the Riverside Convention Center in the Mission District, adjacent to the world-famous Mission Inn. Astronaut Ron Sega will speak at the banquet. For more details, contact *Fred Roberts, Exhibits Chairman, 5464 Peacock Lane, Riverside CA 92505. Tel. (909) 687-8145.*

SEPT 13

BALLSTON SPA, NY The Saratoga County R.A.C.E.S. Assn., Inc., will hold its 12th annual Hamfest at the Saratoga County Fairgrounds in Ballston Spa, rain or shine. Gate opens at 7 a.m. Adm. $4 (includes 1 tailgate spot). Free parking. Door prizes, fox hunt, VE test session. You are encouraged to reserve and prepay for tables, $5 ea. Contact *Darlene Lake N2XQG, 84 Wilton Mobile Park, Saratoga Springs NY 12866. Tel. (518) 587-2384. Packet n2xqg@wa2umx; E-mail [lake@capital.net].* Talk-in on 146.40/ 147.00 and 147.84/.24.

SEPT 14

MONETT, MO The Ozarks ARS will hold its annual Hamfest and Potluck dinner at the City Park in Monett. The park entrance is on Hwy. 37 just south of the intersection of Hwys. 37 and 60. Admission and 8 a.m. tailgating are free. Potluck dinner at noon. Talk-in on 146.97(-) or 145.23(-). For info, call *Joe KB0RVB at (417) 235-8359; or E-mail [nixit@mo-net.com].*

MT. CLEMENS, MI L'Anse Creuse ARC will hold its 25th annual Swap & Shop, 8 a.m.–2 p.m., at L'Anse Creuse H.S. Vender setup at 6 a.m. Indoor tables, $12 ea.; outdoor trunk sales, $5. Admission $4. VE exams at 11 a.m.; contact *Don Olszewski WA8IZV at (810) 294-1567; E-mail [SSTG41a@prodigy.com].* Talk-in on 147.08(+) or 146.52 MHz simplex. For more info, send SASE to *Richard Dzick N8MQU, 31572 Juniper Lane, Warren MI 48093; or call (810) 268-4671.*

SOUTH DARTMOUTH, MA The Southeastern Mass. Amateur Radio Assn., Inc., will hold its annual Fleamarket on the club's grounds at 54 Donald St. in South Dartmouth. The event will run 9 a.m.–1 p.m. Admission is $2 (spouse and children free). Walk-in VE exams at 10 a.m. Space rentals $10. Contact *Bill Miller K1IBR at (508) 996-2969.* Talk-in on 147.00/.60.

TRENTON, NJ The Delaware Valley Radio Assn. will hold their "FallFest '97" at Tall Cedars of Lebanon picnic grove. I-95 to exit 2, S. Broad St. to end, left on Old York Rd., next right onto Sawmill Road. Tailgating, covered spaces, ARRL division official. Admission $5, non-ham spouses and children free. 8' tailgating space $10, includes one admission. Limited 8' covered spaces $15, includes table and one admission. Limited electr. available. Advance reg. available. Talk-in on 146.670(-). For more info, contact *FallFest '97, P.O. Box 7024, West Trenton NJ 08628; (609) 882-2240.*

WHEELING, WV The Triple States Radio Amateur Club will sponsor the Wheeling Hamfest and Computer Show at Wheeling Park, exits 4 or 5 from I-70, 8 a.m.–3 p.m. Admission $3; women, children under 18 free. Talk-in on 146.91(-). Tables under cover, $10; 2 flea markets grass-asphalt, $5 a car. Contact *TSRAC, 2011 St. Hwy. 250, Adena OH 43901. Tel. (614) 546-3930; E-mail [k8an@aol.com].*

SEPT 20

SEBASTOPOL, CA The annual Swapmeet, Auction, and VE testing session held by the Sonoma County Radio Amateurs, Inc., will take place at the Holy Ghost Hall, 1 mi. north of Sebastopol, off Hwy. 116, at the corner of Hwy. 116 and Mill Station Roads. Setup at 6:30 a.m., general admission at 7:30 a.m. Breakfast and lunch will be available. Sellers' spaces are $10 indoors or out. Tables are provided for indoor spaces only. Contact *Rick Reiner K6ZWB, 2120 Slater St., Santa Rosa CA 95404. Tel. (707) 575-4455;* or write *c/o Sonoma County Radio Amateurs, Inc., P.O. Box 116, Santa Rosa CA 95402.*

WARROAD, MN Lake of the Woods Repeater Assn., Inc., will host a Hamfest at Warroad Area Community Center, 222 Virginia Ave. NE, starting at 1 p.m. Setup at 11 a.m. Banquet and program at 5 p.m. VE exams will be given at 2 p.m., walk-ins OK; bring original and photocopy of current license, 2 IDs (one with photo), check for fee. Talk-in on 147.090/.000. Hamfest and banquet $12, Hamfest only, $5. Banquet limited to 100 plates; reservations suggested. Dealer and flea market tables free with paid admission if reserved in advance. Send check to *David Landby KB0HAP, Rt. 3 Box 10, Warroad MN 56763. Tel. (218) 386-1092.* P/U tickets and table numbers at door. Note to those arriving early: Join us for 9 a.m. breakfast at local restaurant.

SEPT 20 & 21

VIRGINIA BEACH, VA The 22nd Annual Virginia Beach HamFest & Computer Fair, ARRL Roanoke Division Convention, will be held at the Virginia Beach Pavilion Convention Center. Show hours are Sat. 9–5 and Sun. 9–4. Load-in and setup on Fri. after 1 p.m. No smoking allowed in the Pavilion. Booths must be attended throughout the show. No breakdowns until after 3 p.m. Freight forwarding is available, info upon request. No outside tailgate this year. Commercial booth spaces available at $150 per 10' x 10' space, including tables, drapes, curtains, elec., 2 chairs, and 2 admission tickets. Additional tickets required for each additional person working the booth. Tickets are not transferable. For more info, contact *Lewis B. Steingold W4BLO, (757) 486-3800 or (757) 426-3378. Fax: (757) 486-0757.*

SEPT 21

ADRIAN, MI The Adrian ARC will hold their 25th Annual Hamfest and Computer Show at the Lenawee County Fairgrounds in Adrian, 8 a.m.–2 p.m. Tickets $4 advance, $5 at the door. Trunk sales, VE testing, forums. Contact *Brian J. Sarkisian KG8CO, 139 N. Main St., Adrian MI 49221. Tel. (517) 265-1537, or [kg8co@juno.com].* The club Web page is at *[http://www.qsl.net/W8TQE].* Talk-in on 145.370(-).

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society, and the Harvard Wireless Club will hold a Tailgate Electronics, Computer and Amateur Radio Flea Market, 9 a.m.–2 p.m., at Albany and Main Street in Cambridge. Admission $4. Free off-street parking. Tailgate room for 600 sellers. Sellers $10 per space at the gate, $9 in advance (includes 1 adm.). Setup at 7 a.m. For space reservations or further info, call (617) 253-3776. Mail advance reservations before the 5th to *W1GSL, P.O. Box 397082 MIT BR, Cambridge MA 02139-7082.* Talk-in on 146.52, 449.725/444.725 pl 2A, W1XMR/R.

CINCINNATI, OH The GCARA "Communications Expo '97" will be held at Kolping Center, 10235 Mill Rd., Cincinnati. This show is sponsored by the Greater Cincinnati Amateur Radio Assn., for the amateur radio, computer, and radio-controlled hobbies and industries. Some of the events being featured are: large flea market, computers and software, hidden transmitter hunt, forums, ladies' programs, commercial vendors, national manufacturers, etc. Admission is $6 in advance and $8 at the gate. For more details, contact *Paul N. Riedel WB8NFT, Chairman, 6850 Edmar Ct., Cincinnati OH 45239. Tel. (513) 733-3900 or (513) 681-6263; E-mail [PNR280@msn.com].*

NEW PORT RICHEY, FL The 7th annual Hamfest & Computer Show, hosted by the Suncoast ARC, will be held at the New Port Richey Recreational Center, 6630 Van Buren, New Port Richey. Admission $5, under 12 free. Tables $15 ea., electric $5. For more details contact the *Suncoast ARC, P.O. Box 1992, New Port Richey FL 34656;* or call *Mimmie KO4FB, (813) 937-7455. E-mail Marv N2AT [MARVB@IX.NETCOM.COM].* Talk-in on 145.35(-) and 147.15(+) rptrs.

NEWTOWN, CT The Western CT Hamfest will be held at the Edmond Town Hall, Rt. 6, in Newtown, 9 a.m.–2 p.m. Setup at 7 a.m. Talk-in on 147.12/.72. New equipment dealers, flea market, tailgating, electronics, computers. Tables $10 ea., tailgating $6 (includes 1 admission). Admission $4 (under 12 free). Contact *Bill Schaeffer N1PJG, P.O. Box 3441, Danbury CT 06813-3441. Tel. (203) 798-2831.*

SEPT 27

SCHNECKSVILLE, PA The Delaware-Lehigh ARC will hold their annual Hamfest this year to celebrate their 50th anniversary. Bring the family and a picnic lunch to the Schnecksville PA Fire Company on PA-309, 4 mi. north of US. 22, to help celebrate. Admission $1. Tailgate spaces $2. No reservations. No inside spaces. Grounds open at 5 a.m. for tailgaters. Talk-in on 146.70 rptr.

DAYTONA BEACH, FL The Embry Riddle ARA and the Daytona Beach ARA have joined forces to present a hamfest on the campus of Embry Riddle Aeronautical University at the Daytona Beach International Airport, 9 a.m.–5 p.m. It will include new and used equip. vendors, VE exams, a fox hunt, and forums. Admission is $4 in advance, $5 at the door, with paved and handicapped parking available. Talk-in on 147.150(+). For info contact *John Munsey at (904) 677-8179; E-mail [K4BV@JUNO.COM];* or check out the Web site at *[http://erau.db.erau.edu/~stokess/hamfest.html].*

HORSEHEADS, NY The 22nd Annual Elmira International Hamfest-Computerfest will be held 6 a.m.–3 p.m. at Chemung County Fairgrounds in Horseheads. Free flea market; ham and electronic gear preferred. VE exams on the grounds at 0900; walk-ins accepted. Dealer displays. Free parking. Bunny hunt. No charge for RVs and trailers coming in Sat. a.m. and out Sat. p.m.. Campers in before 9 p.m. Fri., $15 hookup, $10 no hookup (collected by the county). Admission $4 in advance, $5 at the door; 10 and under free. Make checks payable to *Amateur Radio Association of the Southern Tier, Inc. ("ARAST"),* and mail with an SASE to *Elmira Hamfest, c/o Dave Lewis, 465, CR 13, Van Etten NY 14889. Tel. (607) 589-7495.*

SEPT 28

YONKERS, NY The Metro 70cm Network will present another Giant Electronic Flea Market, 9 a.m.–3 p.m., at Lincoln High School, Kneeland Ave., in Yonkers. Free parking. No tailgating. Indoor flea market only. VE exams. Donation $6, kids under 12 free. Table setups at 7 a.m. To register, call *Otto Supliski WB2SLQ, (914) 969-1053.* Vendors: $19 1st table, $15 each additional. All tables 30" x 5', or bring your own tables at $14 for a 6' space. At the door, $25 each table, $20 for a 6' space. Full payment is due with registration. Talk-in on 449.425 MHz pl 156.7; 223.760 MHz pl 67.0; 146.910; and 443.350 MHz pl 156.7.

OCT 3–4

SPRINGDALE, AR The NWAARC "Hamfest '97" will be held at Jones Center for Families, Corner of Hwy. 265 and E. Emma Ave. (north of the airport), Fri., 7 p.m.–9 p.m.; Sat., 8 a.m.–2 p.m. Setup both days. Vendors, traders, refreshments, forums, prizes. VE Exams (pre-reg.). Admission $5. Tables $6. Tailgate $4. Free parking. Talk-in on 146.70/76(-). Contact *Northwest Arkansas ARC, P.O. Box 24, Farmington AR 72730;* or call *Bryan Spain at (501) 789-2690.*

OCT 5

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Park, 47-01 111th Street, Queens NY. Doors open for vendors to set up at 7:30 a.m.; buyers admitted at 9 a.m. Free parking. Donation: buyers $5, children under 12 admitted free; sellers $10 per space. Talk-in on 444.200 WB2ZZO rptr. and 146.52 simplex. For more info, call *Arnie Schiffman WB2YXB at (718) 343-0172, eves. only.*

OCT 12

DURHAM, CT The Nutmeg Hamfest Alliance will host the Connecticut State ARRL convention with forums and seminars conducted by noted experts. The event will be held in conjunction with the 1997 Nutmeg Hamfest at the Fairgrounds in Durham. Early setup on Sat., and overnight camping will be available. A special Hamfest rate will be available at several motels within a 10 minute drive of the fairgrounds. Inside 6' x 8' booth with a 6' minimum table, $15 ea. Inside 6' x 8' booth only (prepay by Sept. 1st), use your own tables, $5. Outside tailgate/campsite, 30' space, $10. Get a $5 discount if prepaid by Sept. 1st. For further info, contact *George Barker K1BIY, 9 Edgewood Rd., Portland CT 06480. Tel. (860) 342-3258.*

SPECIAL EVENT STATIONS

AUG 30–31

BOWLING GREEN, KY Station N4HID will be operated by the Western Kentucky DX Assn, 0100 UTC Aug. 30th–2400 UTC Aug. 31st, in recognition of the contributions made by animals to science, and for their companionship with mankind.

Operation will be on 7330, 14280, 21380 and 28580 MHz. Certificates will be available. Send name and address to QSL to *Ed Gann N4HID, 445 Elrod Rd., Bowling Green KY 42104.*

AUG 31

THOMSON, IL The Palisades ARC and 90 West DX Assn. will operate Station W9BPT, Aug. 31st, 1700Z–2100Z, to celebrate Thomson Melon Days. Operation will be on the lower portion of the General 40- and 20-meter bands. For a certificate, send QSL and 9" x 12" SASE to *Bob Plumley K9IEG, 1123 West Main St., Thomson IL 61285.*

SEPT 6

MATTHEWS, IN The Grant County ARC will celebrate the 27th annual Cumberland Covered Bridge Festival and Antique Engine, Car and Tractor Show. Station W9EBN will operate 1500–2200 at 7.240, 14.260, and 146.460. Send large SASE to *Chuck Newlin W9C5Y, P.O. Box 135, Matthews IN 46957-0135.*

SEPT 8–13

ATLANTIC CITY, NJ The Southern Counties ARA will operate Station K2BR, Sept. 8th to Sept. 13th, from the Miss America Pageant on Absecon Island (IOTA NA111). Phone: 25 kHz inside lower General class band edge; CW: 65 kHz inside lower General class band edge; Novice: 28.100–28.500 kHz. QSL with a #10 SASE via *SCARA, P.O. Box 121, Linwood NJ 08221.*

SEPT 13 & 14

BENTON HARBOR, MI The Blossomland ARA will operate special event station W8MAI, to celebrate the 50th anniversary of "The Heath Company." Operation will be on all HF bands, and depending on conditions, 6 and 2 meters. An all-Heath station will operate primarily on 20 and 40 meters. Please send all QSL requests to N8SHZ at the *Callbook* address and include a #10 SASE.

SEPT 20–21

RICHLAND, MI The Southwest Michigan Amateur Radio Team will operate NC8O to commemorate the 75th Anniversary of The Kalamazoo Symphony Orchestra. The station will operate on or about 3.975, 7.275, 14.275, 28.4375, 51.375 MHz from 1800 UTC Sept. 20–0200 Sept. 21. For a certificate of commemoration, please QSL to *SMART, c/o Dennis Fitzpatrick, 4378 Vauxhill Dr., Paw Paw MI 49079.*

SEPT 27–28

HAMPTON, VA The VASC Amateur Radio Group, Inc., will operate KE4ZXW from the Virginia Air and Space Center in Hampton. The station will be on the air Sat. and Sun. for UHF/VHF 0000Z–2400Z via KO-23 or KO-25, and on HF both days 1500Z–2200Z. Freq.: Listen at :00+ on 7.265 and :30+ on 14.265. This is in celebration of 2 years of uninterrupted 9600 baud automatic satellite station operation, and management of a fine, visitor-friendly Amateur Radio exhibit. An anniversary QSL will be issued to those sending QSL and SASE to *Ed Brummer W4RTZ, 108 Oyster Cove Road, Yorktown VA 23692.*

Number 46 on your Feedback card

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the December 1997 classified ad section is October 12th, 1997.

BIOELECTRIFIER™ 5 Hz micro current supply for plant and animal research. Semi-Kit $38.00. Assembled complete with batteries and silver electrodes $89.50. Add $2.50 postage. Thomas Miller, 314 South 9th Street, Richmond IN 47374. BNB343

RF TRANSISTORS TUBES 2SC2879, 2SC1971, 2SC1972, MRF247, MRF455, MB8719, 2SC1307, 2SC2029, MRF454, 2SC3133, 4CX250B, 12DQ6, 6KG6A, etc. **WESTGATE**, (800) 213-4563. BNB6000

Ham Dream Home For Sale: Beautiful, passive-solar, custom, 4,000+ sq. ft. hilltop dream QTH, with grandfathered 60' Rohn 45G tower, CL-36 tribander, 11 el. Cush-Craft on 2m, etc. Finest views, both RF and visual, in rural Boulder County CO, but only minutes from both Boulder and Longmont. Ham and computer shack areas designed by EE for flexibility - both current & future. Offered at: $419,900. For complete specs contact Kim Etter of Coldwell Banker Preferred at (800) 727-4495 ext 154. BNB209

COLLOIDAL SILVER GENERATOR! Why buy a "box of batteries" for hundreds of dollars? Current regulated, AC powered, fully assembled with #12 AWG silver electrodes, $74.50. Same, but DC powered, $54.50. Add $2.50 shipping. Thomas Miller, 314 South 9th Street, Richmond IN 47374. BNB342

FM MICRO/LOW POWER BROADCASTING 88–108 MHz. PLL Transmitters/RF Amplifiers/Antennas. Mono/Stereo, 50 mW to 100 Watts. Free Catalog/Info Call (250) 642-2859 or E-mail: [kscott@pinc.com]. **R. Scott Communications Ltd. We Ship Worldwide From Canada!** BNB102

METHOD TO LEARN MORSE CODE FAST AND WITHOUT HANGUPS Johan N3RF. Send $1.00 & SASE. **SVANHOLM RESEARCH LABORATORIES**, P.O. Box 81,Washington DC 20044 USA. BNB421

TIRED OF IRONING? PCB service. No $ setup, free scanning available. **FIRST PROTO**, 4201 University Drive. #102, Durham NC 27707. (919) 403-8243. BNB5005

ASTRON power supply, brand-new w/ warranty, RS20M $99, RS35M $145, RS50M $209, RS70M $249, **AVT, Call for other models.** (626) 286-0118. BNB411

Audio Equipment wanted. 1930s–1960s. Tube-type amplifiers, large or small speakers, mixers, microphones, tubes, parts, etc. Especially Western Electric, Jensen, Marantz, McIntosh, JBL, etc. (800) 251-5454. BNB202

MAHLON LOOMIS, INVENTOR OF RADIO by Thomas Appleby (copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM N3RF**, SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

HEATHKITS WANTED: Premium Prices paid for unassembled Heathkits. Rob W3DX, (804) 971-6812 evenings or [Robcap@aol.com]. BNB206

BREAK THE CODE BARRIER: A self-hypnosis tape that allows you to learn or increase code speed easily and quickly. To order send $14.95 +$3.00 S&H to Dr. Hal Goodman, P.O. Box 184, Eastport ME 04631. For more info, send SASE or [http://www.nemaine.com/w3uwh/morse.htm]. BNB2031

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone**: (616) 925-5899, 8-4 ET. BNB964

CLASSIC RADIOS. RadioFinder Web list revised weekly: [www.radiofinder.com]. TEL/FAX (313) 454-1890 [finder@radiofinder.com]. BNB700

The Communicators HandBook: A Reference guide for the professional engineer or Radio DXer with a list of **FREE** catalogs and Much, Much, More!!... To Order send $9.98 US Check/M.O., Canada $13.50 int'l postal M.O. to: S. Crawford, P.O.B. 83, Riverdale NY 10463. **Fast FREE Shipping**. BNB799

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on p. 88 for ordering information.

98 Books You're Crazy if You Don't Read. Brief reviews of books that will help make you healthy, wealthy, and wise. If you are sick you did it to yourself through messing up your body. This is probably the single most important five bucks you'll ever spend. By Wayne Green. Only $5

NEVER SAY DIE

Continued from page 43

Antarctic rocks aren't missing now?

Baloney!

Actually, I've never liked baloney, either as a food or intellectually. But there sure is a bunch of it around. Wow!

I do enjoy a nice strong salami, even though I know it's lousy fuel for my body. It's the preservatives that'll slowly kill you, just as they do in the other foods which are designed to have a long shelf life.

As a kid my mother never fed me any of the luncheon meats, so my first experience with salami was when I was in the Navy. Every so often a group of us from the Radio Materiel School on Treasure Island in San Francisco Bay were drafted to stand watch at night at the radar lab atop Yerba Buena (Goat Island), the island to which Treasure Island is attached and through which the Bay Bridge passes. Talk about boring on the 12–4 a.m. watch! The break in the boredom came at 2 a.m. when salami on whole wheat sandwiches with an apple were handed out. I've liked salami ever since.

Sorting out the intellectual baloney is more difficult. There's no simple taste test. So I do my best to read the piles of letters from readers who are upset over conspiracies or who are pushing some sort of health food supplement for which they just happen to be a distributor in the usual multi-level marketing approach.

My early family training made a big deal out of being right, with the dictionary coming out frequently to settle word arguments. The result is that I really hate being wrong about things, so I tend to do my homework carefully before reporting on things I think will (or at least should) interest you. So naturally, when I get a letter from a reader saying "I don't always agree with you," my back is up. Oh yeah? On *what* don't you agree? And, sir, have you done your homework or are you just a prisoner of either ignorance or maybe bum dope from school or TV? Most of the time I cite my references and don't ask you to believe what I'm reporting at face value.

If my critics would take the time to read some of the books in my guide they'd be a lot less critical.

But, of course, it's a whole lot easier to just disagree and not bother to read first. And most of us can't help taking the shortcut. When we get sick we want a pill, and don't bother me about how I did it to myself by poisoning my body with sugar, white flour products, mercury and other stuff. Gimme a pill. If it hurts take an aspirin and never mind that the body is sending a message that something is wrong. Don't worry about the cause, just shut off that damned alarm system.

Grumble.

Dim Bulb

In my self-elected role as an iconoclast I've been trashing many of your beliefs—in our schools, colleges, medical industry, money, the federal and state bureaucracies; our war on poverty, drugs, and crime. The fact is, the more I've read and learned, the less respect I have for what we've let happen to our government. The founding fathers had a pretty good thing going here, but through indifference we've let money and power screw it up.

I recognize that mine is a voice in the wilderness, but instead of grumbling about the darkness I'm trying to turn on a small light of reason. There are a bunch of things that have gone wrong, but not one of them that we, as a people, can't fix. And for every complaint I've raised, I've also offered what seems to me like a practical proposal for solving the problem.

Over a hundred years ago Alexis de Tocqueville visited America and said of us, "I do not fear that they will meet with tyrants in their rulers, but rather with guardians." A government led by such men "does not destroy, but it prevents existence; it does not tyrannize, but it compresses, enervates, extinguishes, and stupefies a people, till they are reduced to nothing better than a flock of timid and industrious animals, of which the government is the shepherd." Say baa-a-a.

Crop Circles

Several years ago a farmer from neighboring Francestown called and asked me to come out and see some crop circles he'd found in a field he was mowing. Sure enough, the grass was all stunted in a circle about 20 feet across and a couple feet wide. The farmer said he'd been mowing the same field for years and this was the first time he'd ever seen anything like this.

I talked to the woman who lived next to the field and she told me about a weird experience she'd had a few weeks before when something completely silent hovered over the house, shining down an extremely bright light. It hung there for a few minutes and then moved off quickly toward nearby Crotched Mountain.

When her husband got home she told him about the experience and he ridiculed her for having an overactive imagination. The next day he apologized. He'd been up doing some work at the Crotched Mountain Foundation, where they reported seeing the silent bright light too.

Yes, I know about the farmers in England who've had fun making crop circles, but I also know that most of the circles have no logical explanation, and some are really weird fractal designs, all done in one night, and with no signs of anyone entering or leaving the field.

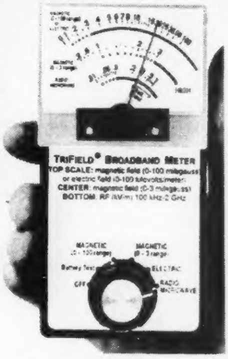
A chap that Art Bell interviewed recently looked at a photograph of one particular crop circle and something occurred to him. It had a group of concentric circles, each with a round lump in it. He thought this looked like the right size and shape for the orbits of the planets. But there was one really strange thing: there was no orbit with the Earth!

So he put the position of the planets in their orbits into a computer to see at what date they would be in that relative position.

ELECTROMAGNETIC MEASURING TOOL

New TriField® Broadband Meter combines **a broadband field strength meter with an AC magnetic & electric field meter** in a single package. **RF field strength setting** (vertical, 10-1000 V/m @ 100 KHz -2.5 GHz) is ideal for making near-field transmitter measurements, finding RFI on a line, testing leaky microwave ovens or finding hidden surveillance "bugs". **AC magnetic setting** (0.2 -100 milligauss @ 60 Hz, range 50 Hz -100 KHz, full 3-axis magnitude) tests for magnetic interference (a sometimes nasty but difficult-to-pin-down problem with sensitive equipment), tells you which of several lines is carrying AC or pulsed current, finds underground power lines, tells you if a power supply or transformer is "on", without contact. **AC electric field setting** (0.5 -100 KV/m @ 60 Hz, range 50 Hz -100 KHz) tells you which line is "hot" vs. "neutral", finds AC wiring in walls, and determines whether equipment is properly grounded.

Includes standard 9-Volt battery, 1 year warranty. Price $170 includes delivery in US , Canada. **Also available: low cost digital DC magnetic & electrostatic field meters, air ion counters. Call for free catalog.**
All meters made in USA by AlphaLab, Inc. / 1280 South 300 West / SALT LAKE CITY UT 84101. Tel. 800-769-3754 or 801-487-9492.
Major credit cards accepted.


TRIFIELD® BROADBAND METER
TOP SCALE: magnetic field (0-100 milligauss) or electric field (0-100 kilovolts/meter)
CENTER: magnetic field (0-3 milligauss)
BOTTOM: RF (V/m) 100 kHz-2 GHz
MAGNETIC (0 - 100 range)
MAGNETIC (0 - 3 range)
Battery Test
ELECTRIC
OFF
RADIO MICROWAVE
HIGH

The NiCad Lady - N6WPA
Losing your source of power?
Have your old case refitted with NEW cells and $ave!
Convert your pack to NiMH!
Same size pack — HIGHER capacity!
***Handhelds *LapTops *Commercial Radios *Camcorders**
***Portable Scanners *Test Equipment *Power Tools**
***Any Special Application**
NEW replacement packs & Individual cells also available!
Call for a price list!
17052 Alameda Drive Perris, CA 92570
(909) 789-0830 FAX (909) 789-4895

It came out to July 2000. The inference is that in July 2000 the Earth might cease to exist.

How could that happen? Well, if a really large comet were to hit the sun on the side away from the Earth it might send a huge flare out the other side which could turn the Earth (and us) into a cinder. He figured the flare would take about 85 seconds to get here. My what a pileup there'd be at the Pearly Gates with billions of people in line, milling around, with the French, I expect, demanding to be first.

Let's look at the bright side, this scenario gives us two more months over Richard Noons's predictions in his book, *5/5/2000*. But it robs us of 12 years of sitcoms and ball games that the Aztecs predicted would come to an end in 2012. And it's in line with the predictions of several "remote viewers" who have been looking into the future and for some reason have been drawing a complete blank after the year 2000.

Hey, if the Earth gets cinderized, where will we reincarnate to? This could discombobulate both heaven and earth. And think of the housing shortage in Heaven!

Call Me

You're familiar with those nicotine patches the poor wretches addicted to nicotine use to try and kick this vicious and destructive stupid habit, right? You put nicotine on the skin and it goes through. Maybe you've read about DMSO, which does the same thing. You dab some on and a little later your breath smells like garlic.

Therefore it shouldn't take a big jump of intellect to suspect that just maybe some of the other things we daub onto our outer membrane may be making a trip into our bloodstream and thence to areas where we might not want said crapola.

I'm reading the label from a P&G deodorant stick. Ingredients: Aluminum zirconium trichlorohydrexgly in an antiperspirant base of cyclomethicone, stearate alcohol, talc, dimethicone, hydrogenated castor oil, polyethylene, silica, dipropylene glycol, eicosanol or benyl alcohol, and pentadecalatone. Okay, trusting consumer, how many of those wonderful ingredients do you want in your blood stream? Hey, note the first (and largest) ingredient is an aluminum compound. Guess where aluminum goes when it gets into the blood? You got it, the brain. Just what you want there to reduce you to a gibbering almost-memoryless idiot, via Alzheimer's.

I'd sure like to see the results of some tests tracking the ingredients in deodorants with tagged molecules from our armpits to the final migration area of the body. What do our bodies do with stuff like that when it starts seeping in through our skin? This is certainly nothing that the evolution of our bodies expected to have to cope with. The minimum disturbance will, I expect, be an attack on the immune system. The worst, layers of aluminum up where the brain used to be.

There are some non-aluminum deodorants on the market. The ingredient list on Suave Super Stick says: Propylene glycol, water, sodium stearate, fragrance, triclosan, FD&C Blue #1, FD&C Yellow #5. So what the heck is "fragrance"? And what mystery chemicals are in the FD&C #1 and 5 colors? I trust the FD&C about as much as I do Congress and the Administration. What will triclosan do when it seeps through your skin into your bloodstream? Well, heck, all life's a gamble, right? So perhaps we should bet the future quality of our health on Helene Curtis, P&G, and the FD&C and forget it. We know we can trust big corporations not to hurt us, right? Like Liggett & Meyers and R.J. Reynolds.

I'm dabbing on some stuff from Now Foods (Glendale Hts., IL 60139). Ingredients are "zinc oxide, talc, rice starch, calendula extract, arnica extract, vitamin E d-alpha, ascorbyl palmitate, citric acid, grapefruit extract in a base of safflower oil, beeswax, lanolin, and natural fragrance. Contains no aluminum or preservatives." I'm not sure about everything in there, but most of it seems harmless, and it does the job. My mother went the Alzheimer's route, so if I find my memory failing I'll recycle my soul and hope to do better in my next incarnation.

If you are interested in getting the Now Foods stuff and have trouble finding it, I suppose I could become a distributor. But then I'd be accused of a conflict of interest and promoting the goo just to make money. But why should I start worrying now about what others think of me? My grandmother was always worried about "what will the neighbors think?" So I'm going to continue to do what I think will be the best for the most people and give my many critics more to talk about.

What other poisons are you putting on your skin? I'm looking at a can of *OFF*. Ingredients are "N,N-diethylmetatoluamide, related isomers, and inert ingredients." My, isn't *that* informative? So how much of those mystery chemicals do you want absorbed through your skin into your blood stream, for your body to figure out where to store?

The can suggests that all is not well by warning against getting the stuff on your lips, into your eyes, or damaged skin, and so on. Plus they recommend that you wash it off with soap and water as soon as you can after using. Plus wash any clothes that have come into contact with it. Sure sounds benign, doesn't it? Oh yes, "If swallowed: Call a physician or Poison Control Center. Get medical attention. If you suspect that you or your child is reacting to this product, wash treated skin and call your doctor." Hey, guys, what about any possible long-term effects as this poison (which is what it is) seeps into our blood and lymph systems? By then it's too late to wash anything off. Lawyers, please note a viable alternative to the Twinkie defense when trying to get your next murderer off.

That N,N-d-m-t stuff must sure be powerful, as they warn against getting it on watch crystals, synthetics, furniture, plastics, leather, or painted surfaces. Oh, yes: "May cause skin reaction in rare cases." I suspect it causes a skin reaction in all cases, it's just that some are more noticeable than others.

And here we are, as I write, in the middle of both black fly and mosquito seasons.

Tax Dollars At Work

The next time you run short of things to talk about in a rag-chew, which I suspect will be in your next QSO, you might want to bring up how our tax dollars are being spent. Presuming that you've been too busy to read any of the exposé books on the subject in my *Guide*, you might just bring up the $65 million we spent training the new police force in Haiti. And now, from the same account, we're spending millions more on Human Rights Watch/Americas to protect people from said new police force.

For instance, when four Haitian police handcuffed Jean Bernard Charles and shot him to death for no apparent reason, his family complained. This was a mistake. They were warned that if they didn't shut up they'd suffer the same fate. Haitians are being tortured by this new police force, just as they were by the old one.

Our foreign policy seems to go from one temporary expediency to another.

New Hams

In May 1997 the FCC reported that 3013 new hams got licensed. Of those 2870 were Techs. That's over 95%. There were 430 upgrades to General. That's almost 15%. Do I have to project the long term results of this trend?

Hey, I ran into a non-retired chap on 20m the other day. It really surprised me. I suspect the average HF operator age is now in the 60s, so in about ten years, unless we change something, there sure isn't going to be much QRM. By 2012, when the end of the world is predicted, I should have most of 20m all to myself.

Laughing All The Way

Norman Cousins laughed his way out of a serious illness. For some reason laughing is good for what ails you. Some people fill theaters with laughter, while others just sit there and smile. If something funny happens you'll know I'm in the theater. I love to laugh.

One of the comments I get very often in letters from listeners to the Art Bell show is how much they enjoy my laugh. No, for all my bitching, I don't take things very seriously.

One of my favorite TV shows is *The Simpsons*. What a bunch of geniuses they've gotten together to write that show! If you enjoy laughing, check out your local Fox Network station for reruns. Their Boston station runs two episodes every evening. I tape 'em and watch 'em while I'm eating the next day, fast forwarding through the commercials.

I also enjoy *Roseanne*, which is also rerunning on Fox. The last year's shows were disappointing. The episodes that have me laughing the most were the earlier ones when David Raether was an associate producer. The credits whiz by too fast to read, but if you slow down the tape you'll see him listed. I noticed because David worked for me for several years on my music magazine and did some fabulously humorous writing.

Continued on page 63

MFJ 300 Watt *Roller Inductor* Tuner

World's only 300 watt AirCore™ Roller Inductor Antenna Tuner gives you absolute minimum SWR . . . Covers 6 Meters thru 160 Meters . . . lighted Cross-Needle meter . . . tunes any antenna . . . 8 position antenna switch . . . dummy load . . . balun . . . 1 year No Matter What™ warranty

NEW!

Covers 6 Meters thru 160 Meters!

MFJ-969

$179^95

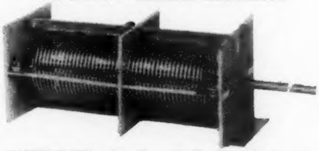
Call your dealer for your best price!

TRANSMITTER
ANTENNA
DELUXE VERSA TUNER II
MODEL MFJ-969
ROLLER INDUCTOR

NEW MFJ-969 gives you MFJ's superb AirCore™ Roller Inductor and full 6 Meter thru 160 Meter coverage!

You get everything you've ever wanted including . . . 300 Watts PEP SSB full featured antenna tuner, widest matching range, lighted Cross-Needle SWR/Wattmeter reads true peak forward power, QRM-Free PreTune™, 8 position antenna switch, built-in 50-Ohm dummy load and heavy duty 4:1 balun -- all in a tough, scratch-proof cabinet.

AirCore™ Roller Inductor



MFJ-969's *AirCore™* Roller Inductor, three-digit turns counter and spinner knob gives you exact inductance control for *absolute minimum* SWR.

MFJ's exclusive *AirCore™* Roller Inductor has an air core *that can't burn up!* You get ultra high-Q, the lowest loss, highest efficiency and highest power handling of any roller inductor in ham radio.

MFJ's exclusive *Self-Resonance Killer™* keeps potentially damaging self-resonances away from your operating frequency.

Large self-cleaning wiping contact gives you excellent low-resistance connection without contact arcing or burning.

Solid 1/4 inch brass shaft has self-align bearings for smooth non-binding operation.

Covers 6 Meters thru 160 Meters

The MFJ-969 covers *all* frequencies from 6 Meters through 160 Meters, *including the "magic band"* -- the widest matching range of any full featured antenna tuner.

Match any Antenna

You can match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave receiving antennas -- nearly *any* antenna. You can use coax cable or balanced feedlines. Has heavy duty 4:1 balun.

Lighted Cross-Needle Meter

MFJ's lighted Cross-Needle Meter shows you SWR, forward and reflected power *simultaneously*. It reads *true peak* forward power and average power on 300 watt or 30 watt ranges.

Meter light has ON/OFF switch and requires 12 VDC or 110 VAC with optional MFJ-1312B, $12.95.

8 Position Antenna Switch

MFJ's 8 position antenna switch lets you select two coax fed antennas, random wire/balanced line or built-in dummy load for use through your MFJ-969 or direct to your rig.

QRM-Free PreTune™

MFJ's *QRM-Free PreTune™* lets you pre-tune your MFJ-969 off-the-air into a built-in dummy load without causing QRM.

Pre-tuning into a dummy load makes tuning your actual antenna faster and easier.

Full Size Dummy Load

The MFJ-969 has a *full size* non-inductive 50 Ohm dummy load.

You'll find it handy for tuning, testing and repairing your rig, setting power level, adjusting your mic gain and more.

Superior Cabinet

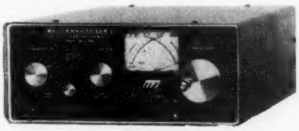
Each MFJ-969 cabinet has a new tough scratch-proof *vinyl* cladding. You won't find a tougher, longer lasting finish anywhere. Measures 3½x10½x9½ inches.

No Matter What™ Warranty

Every MFJ-969 is backed by MFJ's famous one year *No Matter What™* unconditional warranty. That means we will repair or replace your MFJ-969 (at our option) no matter what for a full year.

Call your dealer for your best price!

MFJ-989C world famous *3 KW* Antenna Tuner



MFJ-989C
$349^95

More hams use MFJ-989s than any other 3 KW antenna tuner in the world!

The rugged MFJ-989C handles 3 KW PEP SSB and covers 1.8 to 30 MHz including all MARS and WARC bands.

Match dipoles, verticals, inverted vees, random wires, beams, mobile whips, shortwave -- nearly any antenna. Use coax or balanced lines.

MFJ's new *AirCore™* Roller Inductor, three-digit turns counter and spinner knob gives you exact inductance control for absolute minimum SWR. *It has an air core that can't burn up!* An exclusive *Self-Resonance Killer™* removes damaging self resonances.

Two *massive* 250 pf transmitting variable capacitors with extra wide (0.27 inch) spaced stator plates can handle 6000 volts and amps of RF current for arc-free operation.

Lighted Cross-Needle meter lets you read SWR, forward, reflected power *simultaneously*. Read peak and average power in two ranges.

The MFJ-989C's six position antenna switch is made of two individual ceramic wafers wired in parallel. Wide spaced, heavy duty contacts handle extreme current and voltages. *We've never burned one up!*

MFJ's heavy duty current balun has two giant 2½ inch toroid cores with Teflon® wire connected to ceramic feedthru insulators. You can use balanced lines without core saturation or voltage breakdown.

A *full-size* 300 watt non-inductive 50 ohm dummy load is built-in.

Has convenient flip-stand. 10¾x4½x15 inches. Backed by MFJ's famous one year *No Matter What™* unconditional warranty.

MFJ versatile *1.5 KW* Tuner

MFJ VERSA TUNER III

MFJ-962D
$249^95

Use your barefoot rig now and have capacity to add a 1.5 KW PEP SSB amplifier later! Lighted Cross-Needle SWR/Wattmeter. 6 position antenna switch, *Teflon®* wound balun, ceramic feedthru insulators for balanced lines. 1.8-30 MHz. 10¾x4½x14⅞ in.

Free MFJ Catalog
Nearest dealer/Free Catalog . . . 800-647-1800

http://www.mfjenterprises.com FAX: (601) 323-6551
•1 year unconditional warranty •30 day money back guarantee (less s/h) on orders from MFJ •**Add s/h**

Our 25th Year!

MFJ

MFJ ENTERPRISES, INC.
P.O. Box 494, Miss. State, MS 39762
(601) 323-5869; 8-4:30 CST, Mon-Fri
Technical Help: (601) 323-0549
E-Mail: mfj@mfjenterprises.com

Prices and specifications subject to change. *©1997 MFJ Enterprises, Inc.*

MFJ . . . the world's most trusted name in antenna tuners

Number 50 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

RadioScience Observing ... again

Regular readers know that I have a passion for radio science, especially from the point of view of combining amateur radio and the related listening hobbies (SWLing, scanning, etc.). "RadioScience Observing" is a term I coined for a series of articles in *Short-wave Magazine* (G-land, ... er, UK, to non-hams) a couple years back. It is used to denote a wide variety of activities, including solar flare detection using VLF or short-wave radio signals, radio astronomy, propagation studies, listening to natural radio signals from Jupiter, whistler and spheric hunting, and other related things. Many of these activities can be done with simple radio receivers, while others require rather sophisticated receiver/antenna systems. In some cases, a ham radio license helps, especially when observing propagation anomalies on the air.

During my surfing on the Internet I've found some interesting sites. One of the most interesting from the point of view of information is a publisher who specializes in this subject: Radio-Sky Publishing (P.O. Box 3552, Louisville KY 40201-3552; E-mail [radiosky@radiosky.win.net]; Web site[http://www.win.net/~radiosky]).

The Radio Astronomy Teacher's Notebook, edited by Jim Sky, is a remarkable source of information. Although the book lives up to its name, the material in it is of interest to a far wider audience than teachers. It contains a large number of practical radio astronomy projects that can be built by most readers of this column. It also contains a lot of information of general interest to people who delve into radio astronomy.

The Radio Astronomy Teacher's Notebook is divided into three sections.

Section One: "Simple Observing Programs" deals with solar observations, solar flare detection by short-wave, magnetometer studies, meteor reflection and related topics.

Section Two: Deals with technical issues such as noise, receivers and the mechanism of natural radio signal generation.

Section Three: Is about assembling a radio telescope. It contains a lot of information on recording signals, antennas, low-noise amplifiers, and other components of the receiver. If you have any interest at all in radio astronomy, or any other aspect of RadioScience Observing, then this books belongs on your "must get" list.

Another book I received from Radio-Sky is Radio Astronomy Projects by William Lonc, of St. Mary's University in Halifax, Nova Scotia. Bill, who is known as VE1SMU to the ham community, is a physics professor at St. Mary's and a Jesuit priest. The book contains not only a number of construction projects, but also a wealth of information on radio astronomy. He covers a lot of subjects that normally only mathematicians could love in a manner that makes it accessible to most readers. He also does a good job of explaining interferometry and other radio astronomy techniques.

ANTENNA
MFJ
MFJ ENTERPRISES, INC.
STARKVILLE, MS USA
MODEL MFJ-702
LOW PASS TVI FILTER
SPECIFICATIONS
IMPEDANCE 50 OHMS
FREQ RANGE 0-28 MHz
ATTENUATION 50 dB AT 54 MHz
POWER 100 WATTS
INSERTION LOSS 0.5 Db
V S W R 1.5
I/O TERMINAL SO-239
MADE IN TAIWAN
TRANSCEIVER

Photo A. The MFJ-702.

Sable Island	Eastern Passage	Wynacht Point	St. Mary's University
144.277 MHz	50.001 MHz	222.051 MHz	2304.40 MHz
220.055 MHz	144.29 MHz	432.398 MHz	
222.055 MHz	220.058 MHz	902.358 MHz	
432.40 MHz	222.059 MHz	1296.385 MHz	
902.345 MHz	432.350 MHz		
1296.344 MHz	902.302 MHz		
	1296.302 MHz		
	1296.398 MHz		
The Sable Island beacons are aimed due west towards Halifax, Nova Scotia. The other beacons are all in Nova Scotia.			

***Table. 1.** Beacon frequencies.*

Bill also operates a number of beacons on Sable Island. This island is about 170 miles or so off the coast of Canada, in the Atlantic Ocean. It is well known as both a port of haven for the fishing fleet, as well as a graveyard of ships. Sable Island sits in the middle of one of the Earth's more vicious storm areas. If you want to read a good true thriller on the area, read *The Perfect Storm* by Sebastian Junger. It details a storm that produced huge monster waves, sank some ships and damaged President Bush's Maine vacation home.

One of the stories in *The Perfect Storm* was about a Coast Guard swimmer/jumper who jumped out of a perfectly good helicopter into 60-foot seas to rescue three people on a sailboat. He then jumped into the sea again when it was discovered that the Coast Guardsmen from a nearby cutter were also in trouble during the same rescue attempt. Keep in mind that he does these heroic things for *enlisted* military pay (where do we find such heroic men?).

But enough digression. I exchanged E-mail with Bill Lonc [lonc@husky1.stmarys.ca]. He told me that he would be delighted to receive QSLs, E-mails and other reception reports of his beacons. This is a good chance to do a few VHF/UHF and microwave propagation studies of your own, and would help the scientific efforts of Bill and his students. The beacon frequencies are shown in **Table 1**.

Bill Lonc's web page can be seen on the St. Mary's University website. The URL is [http://apwww.stmarys.ca/~lonc/lonc.html].

The 2304.40 MHz beacon operates using narrow-band FM, but all the others use keyed CW for their ID. Also, the transmitters are all low power [0.5 to 10 watts, except 50.001 MHz (25 watts) and 144.290 MHz (100 watts)].

Product news ...

Received a notice from MFJ Enterprises, Inc. (P.O. Box 494, Mississippi State MS 39762), about a new low-power low-pass filter, their model MFJ-702 (**Photo A**). Hams use these filters between the transmitter and antenna to reduce harmonics that can cause television interference (TVI). The MFJ-702 is rated at 200 watts, and operates over the range 1.5 to 30 MHz, so it takes in all of the HF amateur bands (not to mention CB). It boasts a 0.5 dB insertion loss (which is low), and offers attenuation of 50 dB at 54 MHz. It will, therefore, protect TV channel 2 and up. The MFJ-702 comes with SO-239 standard coaxial connectors, and is sized at 6 x 1 x 1.5 inches. For additional information, write to Richard Critz Stubbs, Jr. KC5NSZ, at the MFJ address given above. 73

Please call 800-274-7373
and
Subscribe to 73 Magazine

Number 51 on your Feedback card

ASK KABOOM

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

A colorful world

For several months now, we've been exploring the history of video technology, from the first conceptualizing of television to the modern home VCR. Last time, we saw how the basic problem of tape consumption was finally solved.

I mentioned that the azimuth recording scheme worked fine in black and white, but not in color. Ah yes, color—the bugaboo that delayed the VCR for years. Let's see how they finally got it all to work.

Divide and conquer

If deliberately misaligning the video head azimuth kept the signals from the *A* and *B* heads separate, why wouldn't it work in color? Before we get to that, we have to take a look at how color was, and is, recorded in the first place.

It seems logical that you could simply record the entire video signal, including its color subcarrier, and be done with it. Indeed, you can do that. Unfortunately, when you play it back, you won't get usable color on the screen! Why not?

Remember, way back when, that I mentioned the color signal's being very touchy with regard to timing? Even a few nanoseconds of jitter (wobbling in time) will ruin the color. That's a natural side-effect of the basic color encoding scheme, which makes the color value dependent on the subcarrier's changes in phase. "Phase changes," of course, is just another way of saying "a change in timing." Timing errors are indistinguishable from desired phase changes. And that's why timing errors are unacceptable in color TV signals.

When transmitting the signal over the air, timing isn't an issue, because it doesn't change. Well, that's not entirely true; if you've ever had the misfortune to live in an area plagued by TV ghosting, such as Boston, you've seen what it does to color signals. Assuming a good, ghost-free path, though, color travels well.

It does *not* record well. No mechanical system can possibly maintain nanosecond-level timing, not even the ultra-precise quadruplex broadcasting machines which cost more than most people's homes. Tape wobble, bearing play in the head drum, and even thermal expansion and contraction of the tape and drum all introduce errors several orders of magnitude greater than what's needed for good, accurate color. So, how was that problem finally solved?

Bump it down

The key to making color work in the low-cost, helical video recorder was to strip the subcarrier off from the rest of the signal and process it separately, recombining it only near the end of the playback chain of circuits.

Certainly, it was possible to record the entire signal, including color, and then strip the color off and fix its timing problems on playback. That was called "direct color recording," and such machines were built. The drawback was that, due to the color signal's rather high frequency of about 3.58 MHz, lots of bandwidth was required on tape. Remember, video is recorded using FM, so it takes *way* more MHz to put it down on tape than are contained in the actual signal being recorded. The result was very fast head-to-tape speed, wide, expensive tape and big machines, none of which suited the home market. Also, the signal-to-noise ratio was a big problem at such high frequencies, making the color grainy unless very high-quality circuitry was used. While being successful in high-end industrial and broadcast recorders, direct color recording was clearly not the answer for a consumer machine. Besides, even with direct recording of the color signal, some kind of timing correction would have to be applied on playback before usable color could be obtained.

A trick

Color television depends in large part on a trick: the human eye doesn't see fine differences of color when objects are close together. In effect, we see a kind of pastel, with sharp brightness variations and soft color variations. In fact, that's why the whole color subcarrier scheme worked in the first place—because it didn't require tremendous amounts of bandwidth in the signal. In other words, the color elements of the picture never had to be very sharp, as long as the luminance (or black-and-white) part of the signal was.

That meant the color signal didn't really have to be at such a high frequency to begin with! While it was convenient to use a high frequency for getting the signal to coexist, relatively interference-free, with the luminance signal, a lower frequency would still have enough bandwidth for good color. Enter the mixer.

Just like your radio

As you know from your radio pursuits, it's not hard to mix a signal with another one and get the sum and/or difference frequencies between them at the output of the mixer. That's exactly what was done in the color video recorder. First, the color signal was stripped off the rest of the signal, using a filter. Then, it was mixed with a crystal oscillator to make a lower-frequency signal. The resulting signal still had its phase and amplitude changes modulated on it, just as a radio signal does when your rig mixes it with the VFO to get to the IF frequency.

The new, relatively low-frequency signal (around 600-700 kHz in modern home VCRs) was then combined with the FM carrier that handled the luminance signal and applied to the video heads. They didn't interfere with each other, because the FM carrier's lowest frequency was set well above the sidebands of the new color signal.

Seems pretty simple, huh? Could that be all that was required to make a color VCR? Hardly! While it got the signal on tape without increasing the required bandwidth, in no way did it provide a way to get the color *off* the tape and onto the TV screen! Those nasty timing problems, caused by the inescapable mechanical issues I mentioned before, still remained. Solving them is where things got clever and tricky.

Good ol' PLL

Being a ham, you're probably at least somewhat acquainted with the operation of a PLL, or phase-locked loop. Basically, a PLL is a circuit that makes one oscillator track another one's phase. It seems like a useless idea at first, but it turns out to be one of the cleverest and most useful circuits around, finding its way into all kinds of things, from computer hard drives to the frequency-controlling circuits on your rigs.

The PLL has been known since the vacuum tube days. At that early stage of technology, though, it wasn't very practical, because it took lots of circuitry, which meant lots of hot, power-hungry tubes and tons of room. The PLL languished until the solid-state revolution. Even then, it took a board full of transistors, resistors and capacitors to make a useful one—so its use was limited to expensive military and industrial gear.

Nonetheless, use of the PLL had begun to come into its own by the 1970s, at just about the same time the EIAJ standard for half-inch videotape was created. As it turned out, the PLL was the answer to the recovery of color signals from videotape!

Well, this discussion of color processing is gonna be a doozy, and I'm nearly out of room for this month, so I'll leave it until next time. Until then, 73 de KB1UM.

Share with a friend the gift Wayne wants for his 75th birthday present ... make them both happy!

See page 88 and *Never Say Die*

Number 52 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
P.O. Box 508
Massillon OH 44648

Perhaps the simplest antenna to erect is the random length wire antenna. All you need are two supports and some wire. Throw in an antenna tuner and you're ready to make contacts.

Random length and longwire antennas

Sometimes we get these two guys confused. I have caught myself referring to a longwire as a random length. What's the difference between the two?

A random length antenna is just what the name implies. Its length is random. Supported between two trees, towers or even houses, the length is dependent upon the supports. If you have a tree 80 feet from your tower and you run a wire from the tower to the tree, your random length antenna is 80 feet long. It's that simple. The random length antenna is fed with a single wire. This feedline also becomes part of the antenna's length.

The longwire antenna, on the other hand, is as long as the lowest frequency wavelength. A 160-meter longwire would be very, very long! Some people also consider a longwire to be shorter than the full wavelength as long as it is at least one half wavelength long for a given frequency. A longwire can only be called "longwire" if it is long in terms of wavelength.

The random wire

Because we have little control on the placement of our supports, we must go with whatever length wire we end up with. Since we don't know at what point along the wire there will be a current or voltage point, it's hard to load a random length wire. Depending on frequency, and the length of the random wire, the feedpoint may have a very high impedance. On the other hand, change the frequency and our feedpoint may have a very low impedance. To counter these oddball input impedances, we need an antenna tuner. Now, before the hate-mail starts pouring in, some of the older tube-type transmitters had a pi-network in the RF output stage that could load a random length wire antenna, provided the antenna was long enough and the feedpoint impedance was close to 50 ohms. Today's solid state rigs lack this pi-network.

Again, since we don't know if we will be feeding a voltage or current point along the wire, random wire antennas have a history of allowing RF in the shack. Running 100 watts with a random wire can sometimes cause the microphone to be hot with RF. The RF floating around the shack can cause all kinds of trouble ranging from RF burns on the lips to sticking electronic keyers. To combat the RF in the shack trouble we need two things.

First, we need a real honest-to-goodness earth ground. Second, we need that antenna tuner I talked about.

A tuner for a random length wire antenna is quite easy to make. All you need is a tapped inductor and a variable capacitor. The schematic for the tuner I made is shown in **Fig. 1**. It's a classic that's been around for decades.

The antenna tuner

Because we're dealing with a random length wire, we have no idea what the feedpoint impedance will be—so we need a tuner that will allow our low Z transmitter output (50 ohms) into an unknown Z.

The tuner I use is very basic. In this configuration, only two components are used. A variable capacitor and a tapped inductor is all you need! Change the wiring a bit and by adding an additional capacitor to the antenna side of the inductor, we end up with a classic pi-network.

In the version I used, the variable capacitor must be isolated from ground. This means you must keep the capacitor's shaft above ground. You'll need some kind of insulated shaft coupling. I've used small hunks of wood in the past with reasonable success. Short pieces of hard rubber tubing slipped over the capacitor's shaft work, too. You'll need a panel bushing and a 1/4-inch shaft extension. I've used old pots for both. The pot is dissected and the bushing removed. The end of the shaft is ground off (to get rid of the pot's wiper) and the coupling attached. The only problem is that the newer pots don't use the standard 1/4-inch bushing anymore. However, I think you still should be able to come up with a working solution. No matter how you do it, the variable capacitor must be insulated from ground.

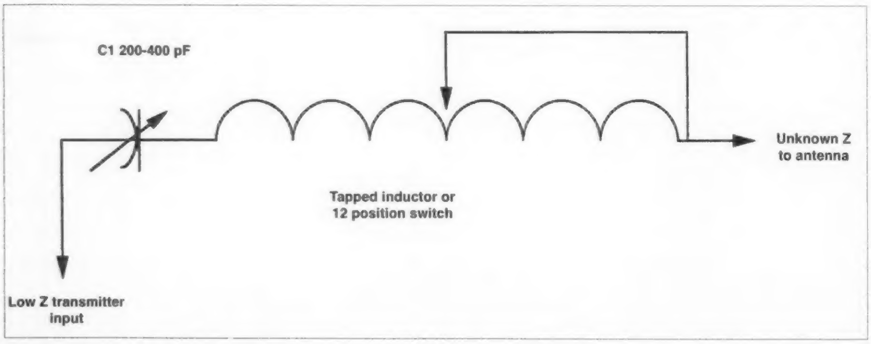


Fig. 1. Schematic for the tuner.

Getting the parts

Since this is the '90s, such parts as variable capacitors and tapped inductors are not easy to come by. You'll need to go through your catalog pile and start looking. The variable capacitor I used has three sections of about 125 pF. I ganged all three together for a total of about 375 pF. That's about perfect for all bands except for 160 meters. If your random wire is "long" enough, you might be able to squeeze 160 meters with 375 pF.

A good source of a 200 to 400 pF variable capacitor would be the broadcast variable used in the old AM radios. In fact, the one that I used came from a AM radio. I purchased mine from Hosfelt Electronics for a few bucks. Check All Electronics, Surplus Sales of Nebraska and Fair Radio sales of Lima, Ohio.

If you plan on running just one band with your antenna, you may be able to use an assortment of fixed capacitors and switch them in and out of the circuit.

At QRP RF levels, you can get away with the one-inch-square variable poly caps from transistor radios. Attaching knobs to these guys can be an interesting engineering project! Remember, you must keep the capacitor isolated from ground.

The inductor is a bit easier to come up with. Perhaps the easiest inductor would be a hunk of Aircore or B&W coil stock. Hardly Radio Shack™ stuff, but Surplus Sales of Nebraska may have some. How much do you need? Rule of thumb: You will require more inductance for the lower bands.

I made my own inductor out of a length of #14-gauge solid wire. I first took the wire and wound it around a broom handle. Then I laid out some holes in a hunk of perfboard. The holes were spaced an equal distance on 1/4-inch

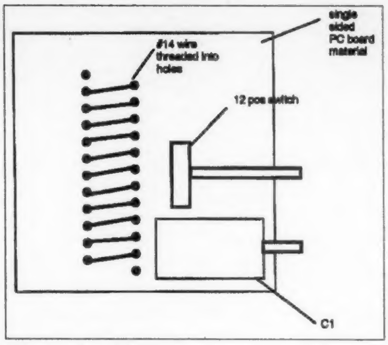


Fig. 2. The inductor.

centers. A second run of holes was spaced one inch from the first holes, but these were offset by one hole **(Fig. 2)**.

In effect, I made a screw pattern that allowed me to screw the preformed wire into the perfboard. To make the taps, I soldered wires to every other link at the board. From the board these taps were connected to a 12-position switch. The switch is located close to the inductor. A shaft extension and panel bushing makes the switch assembly very sturdy. Radio Shack handles a 12-position switch that will work at QRP power levels. Just don't switch selections while the power is flowing.

You can wind your inductor around a T-200 core, too. The core size is large enough to handle the wire size required. The larger core size makes winding the wire easier, too. Mount the core on the back side of the rotary switch, keeping stray inductance in check.

If you want to get real serious, order the tapped inductor from Ten-Tec™ that they use in their smaller antenna tuners. It's not cheap, but it provides a zillion taps in a small area. Ten-Tec also carries the shaft couplings and panel bushing. Give them a call for prices.

If you don't want to use a switch to select the inductor taps, that's fine. A clip lead may be used to find the tap you need. It's a trick that's as old as radio itself.

Building the tuner

Antenna tuners should be placed inside a metal box. If you must use plastic, then use copper PC board material to line the inside of the box. A good earth ground is a must for proper operation.

Using the tuner

You will need an SWR indicator of some sort. Basically, you adjust the tuner to minimum SWR. If you can't achieve a low SWR, then move the inductor tap and try again. It's best to go after the least amount of inductance and maximum capacitance. There may be more than one setting that will produce an acceptable SWR. Try and find the one that uses more C if you can. You will get better efficiency if you do.

The Rainbow antenna tuner

While we're on the subject of antenna tuners, at the Dayton HamVention the New Jersey QRP club introduced their Rainbow tuner. Designed by Joe Everhard N2CX, the Rainbow antenna tuner is designed specifically for the 30 and 40 meter bands. You need an endfed half-wave antenna for the Rainbow to work.

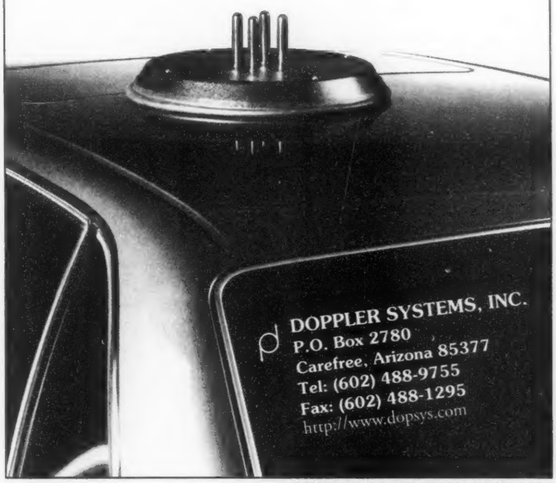
The Rainbow tuner has a rather slick interface that uses several colored LEDs, hence the name Rainbow. The LEDs give the user an indication of the SWR on the antenna. An LM339 voltage comparator samples the voltage produced by an absorptive resistive bridge. The resulting voltage is compared against a reference. A high SWR produces a higher voltage which in turn lights the correct LED.

The Rainbow is a slick tuner that will fit inside most of the current breed of QRP transceivers. You can buy your own Rainbow tuner from the New Jersey QRP Club for $25. To order write: George Heron N2APB, 45 Fieldstone Trail, Sparta NJ 07871. Make checks out to George Heron, *not* to the New Jersey QRP Club. You can also contact George via E-mail at: [g.heron@dialogic.com]. Armed with a home-brew tuner and a random wire antenna, the QRP operator has one of the fastest portable setups in the world. Of course, you'll need at least two supports for the wire, but you won't need to carry along coax or connectors.

TRANSMITTER LOCATION

Direction Finding System Tracks Down
- Stuck Microphones
- Cable TV Leaks
- Jammed Repeaters & Cell Sites

Models available with computer interface, synthesized speech, for fixed or mobile use, covering 50 MHz to 1 GHz. Call or fax for details



DOPPLER SYSTEMS, INC.
P.O. Box 2780
Carefree, Arizona 85377
Tel: (602) 488-9755
Fax: (602) 488-1295
http://www.dopsys.com

CIRCLE 13 ON READER SERVICE CARD

AMATEUR TELEVISION
web site: www.hamtv.com

Made in USA
Wired and tested boards start at $49
TVC-4G only $89

SEE THE SPACE SHUTTLE VIDEO AND GET THE ATV BUG

Many ATV repeaters and individuals are retransmitting Space Shuttle Video & Audio from their TVRO's tuned to GE-2 (85W) Tsp 9 vertical or weather radar during significant storms, as well as home camcorder video from other hams. If it's being done in your area on 420 - check page 577 in the 97-98 ARRL Repeater Directory or call us, ATV repeaters are springing up all over - all you need is one of the TVC-4G ATV 420-450 MHz downconveters, add any TV set to ch 2, 3 or 4 and a 70 CM antenna (you can use your 435 Oscar antenna). You dont need computers or other radios, it's that easy. We also have ATV downconverters, antennas, transmitters and amplifiers for the 400, 900 and 1200 MHz bands. In fact we are your one stop for all your ATV needs and info. We ship most items within 24 hours after you call.

Hams, call for our complete 10 page ATV catalogue.

(818) 447-4565 M-Th 8am-5:30pm
P.C. ELECTRONICS
2522 Paxson Ln, Arcadia CA 91007
Visa, MC, UPS COD
Email: tomsmb@aol.com
24 Hr. FAX (818) 447-0489

Number 54 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

With this column (#24), Ham to Ham concludes its second year in the pages of *73 Amateur Radio Today* magazine. Thanks to all of you who've been supportive over the last two years by sending in your many tips, ideas, suggestions, and shortcuts for the rest of us. With an average of four or five tips per month, that's well over a hundred ideas that we've been able to relay so far ... not bad! I always welcome more of your input, however, so don't feel that your own ideas aren't worth submitting ... they are! The basics are pretty simple: What do you feel would be of interest to your fellow hams and electronics hobbyists? That's what I'm hoping to see from you. Anything having to do with ham radio and electronics is appropriate (not all readers are licensed hams ... yet!). Since ham radio encompasses just about the entirety of electronics, it's conceivable that just about any tip in this field of general electronics will likely have some application in our ham or SWL shacks. So fire up your word processor and send me some of your favorite shortcuts. You can send them by Uncle Sam's slow-mail, by cyber-mail, or via the Ham to Ham home page feedback button on the Web at [http://www.rrsta.com/hth]. Take some time to browse the neat page that Mark Bohnhoff WB9UOM has come up with for us. Now, onward to this month's offerings:

Nailing it down!

From Frank Brumbaugh W4LJD: "If you haven't tried it, Liquid Nails™ is a good general-purpose adhesive for holding down trimpots, small relays, electrolytic capacitors, and any number of small parts on a printed circuit board or metal chassis. As hams and electronics experimenters, we often find ourselves adding parts to an otherwise completed item of equipment. Consequently, we don't usually have the luxury of solder pads and pre-planned holes right on the PC board itself for mounting these additional necessities. Super Glue™ is one answer, but it's expensive and a standard tube holds very little. Liquid Nails (manufactured by Macco Adhesives, The Glidden Company, Cleveland OH 44115) is less costly, and a 4-ounce tube will last quite a long time. It's sold to the construction trade as a drywall and paneling adhesive in larger caulking-gun size tubes, but the 4-ounce consumer-sized squeeze tube is great for occasional use by the home hobbyist. It will work with ceramics, metals (including aluminum), rubber, wood, plastic, and so forth. It has a very thick consistency (unlike Super Glue), so it won't run and get into areas where it might be unwelcome! It's very sticky stuff and will begin to set up quickly upon exposure to the air, so you'll need to have the parts that you want to 'nail' down ready before opening up the tube. It takes a day or so for full curing, but the parts will hold pretty well in place considerably sooner than that. Cleanup can be done with mineral spirits and, of course, as with any petroleum distillate product, adequate ventilation is a must. By the way, it comes with a 50-year guarantee ... think the equipment you're working on will last that long?"

Moderator's note: Frank's right. Liquid Nails is a nice product to have around the ham workbench. At Frank's suggestion, I tested it for RF transparency in a microwave oven and it passed. When completely set up (cured), it doesn't seem to absorb any appreciable microwave energy, so it should be reasonably safe to use around RF circuitry. In case you're not familiar with the "microwave oven test," putting a sample of insulating material into your home microwave oven, along with a small cup of water, is a good way to test for RF absorption. If the sample doesn't get warm when the oven is run for a minute of so, then it's pretty safe to assume that it's transparent to radio frequencies (which all insulating materials used in the RF area of ham gear should be). The only other caveat that you have to watch for is moisture absorption (the adhesive becoming hydroscopic). Some adhesives will absorb moisture from the air, with time and age, and can become semi-conductive. Obviously this can cause all manner of strange problems when the adhesive is laid across two or more copper printed circuit board traces. Even a hundred kilohms or so of resistance can upset high impedance circuits quite a bit, and lower resistance can even do some irreparable damage. Keep an eye on that with any new product that you might try.

Two ears are better than one

From Thomas Hart AD1B: "Last year I discovered the fun of hamming through the RS-12 satellite and have been busily chasing DX using it ever since. My usual mode of operation has involved running my Kenwood TS-430S in the dual-VFO mode, and transmitting on 15 meters while receiving on 10 meters. This is what's called mode K operation. It's necessary to estimate the Doppler shift offset by the hit-or-miss method, because the 10 meter receive frequency on the transceiver is silenced during transmit, but this is a reasonably uncomplicated way to utilize RS-12. I've been able to confirm 38 states and 16 countries in just 7 months of working with the satellite in my spare time. A true ham never being satisfied, I recently added the luxury of being able to listen to my return signal on two meters with the addition of another receiver (see last month's 'Ham to Ham' column). This necessitated yet another innovation as described below.

"To listen to my two radios at the same time via headphones, I bought a Sony™ stereo headset at a discount store for just $6 and completely reworked their wiring. I removed the original cable and replaced it with two separate lengths of lightweight 2-conductor speaker wire from Radio Shack™. Each of the new 2-conductor wires then terminates in a connector (also from Radio Shack) appropriate for the headphone jacks of the two radios that I'm using as downlink receivers ... so I've ended up with two meters in my right ear, and 10 meters in my left ear! It's interesting. At times, one frequency may be more audible than the other (due to propagation, background noise, antenna pattern differences, etc.). At other times, reception in both ears is quite good and I have excellent 'stereo' perception using this arrangement. It was a little spooky at first to hear my uplink (sidetone monitor) in my left ear and my satellite downlink CW in my right ear, but now it seems perfectly normal and I'd miss it if I were to go back to the old way! It's an inexpensive way to give this method a try."

*Moderator's note: If you'd rather not completely rewire the headset as Tom did, you could achieve similar results by "splitting" off the two phones of the stereo headset by using a standard three-conductor stereo jack and coming from it with two lengths of two-conductor speaker wire ... to each of the receiver's headphone outputs. This works only if both receivers share a common ground point and if one side of their headphone outputs is not "above" ground (which is usually the case). See **Fig. 1** for a basic drawing depicting this idea.*

The old hobby knife trick!

From Phil Salas AD5X: "Here's a quick tip to remember the next time you need to cut out any type of large hole in a plastic project box. I use a hobby knife (like the X-Acto™), heated with my normal bench soldering iron.

"Tin the upper part of the knife blade (the part that's closest to the handle) with some solder, then hold your soldering iron on this tinned spot as you carefully cut the plastic. Always carefully predraw the figure that you want to cut. Scribing it with a sharp metal scribe will also help to keep you on track for the final removal cuts. It's actually pretty easy to do after you've practiced with it once or twice on a piece of scrap plastic. You can cut round meter holes or even rectangular LCD display cutouts using the heated knife method, once you've developed a feel for what it's like."

Moderator's note: It's also best to use the type of hobby knife handle that's insulated with a cushioned rubber covering, to prevent burns from those calories conducted up the handle from the heated blade. If your X-Acto handle is of the bare metal variety, however, you can slip some large-diameter cable insulation over the handle instead ... try using the outer insulation from RG-8/U.

Improved linear amp input circuitry

From Rich Measures AG6K: You may remember from May's column that Rich suggested a method of more closely matching your transceiver's output drive level to your amplifier's maximum linear input drive level (the maximum RF drive level that should be fed into your linear if you expect to keep it linear). Rich explained how to determine the value of an RF input "pad" and then how to install this pad in series between the amplifier's input coupling capacitor and the amplifier tube's cathode. The following quote is from Rich's suggestion:

"If you look at the specs for today's popular amplifier-tube crop, you'll find that the bulk of the new ceramic triodes require anywhere from 22 watts to 75 watts input RF for full output—anything beyond that results in saturation drive (distorted audio). Yet how many popular transceivers are rated in the 22 to 75 watt range?"

Here Rich continues with another note on the subject and some additional worthwhile information on improving the SWR for your linear amplifier's input tuned circuit: "When I first installed a series/parallel resistance combination in-line with the RF drive feed in a commercially-available amateur HF amplifier using a single 3-500Z tube in a grounded-grid configuration (see the May 1997 column), I experienced a better SWR match on some bands and a slightly degraded SWR on others. This variation was added in the direction that the original input matching circuits were off to begin with. In other words, if the input matching circuit's impedance was too low to start with, the additional 20 ohms of resistance in the amplifier tube's cathode actually improved the SWR match, but if the original input impedance was too high, the SWR degraded.

"The answer, of course, is to achieve a better match on the amplifier's input via the amp's input tuning network, and this brings up another interesting point that a lot of hams tend to miss: The actual impedance transformation of a pi-network tuned circuit cannot be optimally altered without changing at least two of the three pi-network components, yet most commercial amplifiers allow you to change only one.

"**Fig. 2** shows how the input matching circuits of most commercially made amplifiers are configured. A slug-tuned coil adjustment (if that's what your amplifier's tuned input circuit uses as the variable element) will rarely deliver the lowest possible SWR when tuned just by itself! Although it will indeed move the resonant frequency of the network, which will change the indicated SWR, the final SWR may not be the lowest level possible because only one element in the pi-network has been varied. Anyone who has experimented much with his linear's tuned input circuit has probably made this discovery for himself.

"What's the answer? One of the fixed capacitors in the pi-network should also be varied ... and that's not as tough as it sounds. It's usually very easy to temporarily parallel one of the tuned circuit capacitors with a compression-mica trimmer variable capacitor. You can then alternately adjust the slug-tuned coil and the trimmer until the input SWR has been minimized (it should now end up being close to 1:1 at some point in any selected band). If, by chance, there's already too much capacitance in the network, then of course one of the fixed capacitors will have to be disconnected temporarily from the pi-network and a trimmer of approximately the correct value used in place of it. Once an optimum value has indeed been reached, the variable trimmer can be carefully removed, measured and a new fixed capacitor (or parallel combination of fixed capacitors) installed in its place.

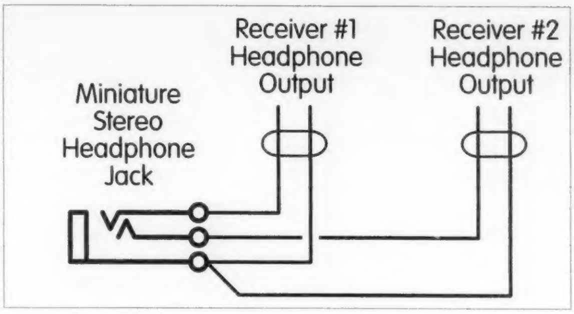


Fig. 1. Wiring of stereo headphone adapter for dual satellite receiver reception.

"Now, as a final touch, reduce the value of the pi-network's variable inductance, just slightly, by backing out the slug a little bit from its optimal point. This technique will raise the 'Q' of the circuit somewhat; I've found that most solid-state transceivers prefer a somewhat higher 'Q' for best performance. Eimac (the well-known amplifier tube manufacturer) recommends using a 'Q' of 2 for grounded-grid amplifier tuned circuits, though in fact many amplifier manufacturers design for a 'Q' of 1. This too results in less than optimum SWR from the tuned input circuit.

"The above procedure will have to be used for each of the tuned input circuits in the amplifier, usually five or six bands. Take your time when you take on this project, and make notes at each step along the way to answer any questions that may come up at a later time."

Moderator's note: Rich brings up a very valid point. You wouldn't expect to be able to a achieve a nearly perfect match on the output of your linear if only one of the pi-network components was variable, so why would we expect any more from the input matching circuit? Making at least two of the components in the network variable makes good sense. A variety of small variable trimmer capacitors, in the general range of 2 pF to 180 pF, can be obtained from some of 73's advertisers, including All Electronics [(800) 826-5432)]; Fair Radio Sales [(419) 227-6573]; and others.

Murphy's Corollary: Whenever a specialized defective part has been positively located, it will be the only one that is not mentioned anywhere on the manufacturer's "Complete Parts List".

By the way, if you need data on a specialized part, try looking on the Internet under the part manufacturer's Web page. Many parts manufacturers now have datasheets available for downloading via the Internet. This makes it much quicker, in most cases, to obtain needed information than writing or calling the

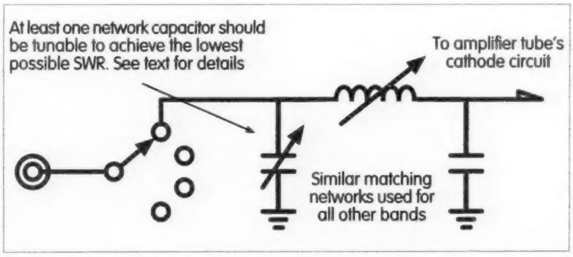

At least one network capacitor should be tunable to achieve the lowest possible SWR. See text for details
To amplifier tube's cathode circuit
Similar matching networks used for all other bands

Fig. 2. Typical pi-network used for input matching in a commercial amateur linear amplifier.

Number 56 on your Feedback card

THE DIGITAL PORT

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

The BayPac™ adventure

I have received a number of inquiries about the BayPac modems, so I will devote this month's column to my experiences with the new BP-2M multimode. Having heard numerous good reports, I wanted a firsthand experience.

Good info on the Web

The hardware is very compact because the system is software dependent. I checked out the various sites on the Internet and found there is a Web site originating in Bavaria which is the birthplace of Baycom. The Bavarian Packet Radio Group [www.baycom.de/] is actively pursuing new developments in packet design. The Web site displays their new 9600 bps modem schematic for the avid builder.

TigerTronics has a very informative commercial Web page [www.tigertronics.com] that lists many of the programs available for the BP-2 and BP-2M and has some of them ready for download.

I called their toll-free number (after clearing the purchase with the wife), asked a few questions about software and gave them my order. The salesperson was very courteous, even to the point that she promised shipping in time to fit my schedule. This is being written during a 1600-mile round trip to Washington state to see our youngest son's family and inspect the newest grandson.

The timing was so close that it looked as though the promised arrival date was about to come and go, so I called TigerTronics to confirm shipping and got the UPS tracking number. Upon entering that number in the UPS Web page I found the package was in the area—and sure enough, the truck pulled up about 15 minutes later. Patience is one of those virtues I am working on (a little haphazardly, but it's coming along).

The next day we started on our big adventure, and as my wife drove, I read the installation disk in my laptop. The README.DOC text was informative. However the *.EXE files wouldn't load. There was an error displayed on the screen that indicated corrupted files.

An hour or so later, we were driving through Grant's Pass, Oregon, the home of TigerTronics, so I gave them a call on the landline. I talked to a pleasant tech person and he informed me that if the files were corrupted that would be a first, but I could download fresh files from the Internet on their Web page.

Very picky DOS format

That was fine, the least of several inconvenient choices; I decided I would do that when we reached Washington. Then ... my mind started running through bits of information I had stored there from their literature. One piece said the program would not run with Windows© running, not even from a DOS window and that was what I was using, not realizing the install program was included in that category.

I fired up the laptop in DOS mode, told it to install from the floppy and voilà! Success. I spent the next few hours reading BayPac instructions from the screen (I hate to use the little portable printer with the car under way).

Wiring is easier

Before I left home I found the wiring for connecting the Icom W2A to a regular everyday TNC. I wanted to hook up the BP-2M while in Bremerton and amaze my offspring engineer whiz. So I was prepared ... I thought. One of the differences when using BayPac is that they have included extra circuitry in the modem that allows it to key most handhelds without adding any resistors or capacitors in the cable. This is made clear in the HINTS.DOC included on the disk.

Now I was really armed and ready for action. I still had to wait for several hours for Washington to appear over the horizon, then get the simple wiring out of the way the next day, find the local PBBSs and really impress friends and family.

In the meantime (it's always good to have a little delay to justify reading the documentation), I checked several of the other text files. In all, I counted eight of them, and they are all well-written and understandable. The files covered everything from mating components and basic operating techniques to the advanced features available with my new toy.

I experienced the dreaded little hitch after hooking up the new packet station. It would neither receive nor transmit. The BP-2M comes with a neat little program, BPMODE.EXE, that will search all the Comm ports to detect the modem. Once it has performed this function, you can select the mode you wish to use and make necessary tests and adjustments.

When I ran BPMODE my IBM Thinkpad™ 365XD appeared unable to find either Comm port #1 or #2 regardless of what I wrote into the SCC.INI file. I read through the long documentation that came with the software and found a wealth of wonderful things I was going to do with this modem if I could just get the software to converse with a serial port.

Some combinations don't work

There was a clue that I might be fighting a losing battle with this combination. Or at least until I could find someone who has a work-around for the problem. The clue is that there are some laptops that just couldn't be made to work with the software. The named laptops did not include mine but that may be included now because the documentation was written before my laptop was on the market. Ah ... to be on the cutting edge!

This problem did put a damper on the big demonstration, but it made me think. One thought was that I have a strictly DOS machine sitting home (800 miles away).

---

manufacturer directly. Use one of the many search engines (such as Yahoo™, Web Crawler™, Alta Vista™, or others) to find what you're looking for if you don't have an exact address. And while you're browsing the Internet, be sure to check out the "Ham to Ham" column's home page on the World Wide Web at [http://www.rrsta.com/hth].

As always, many thanks to this month's contributors, including:

Frank Brumbaugh W4LJD
P.O. Box 30
c/o Defendini
Salinas PR 00751

Thomas M. Hart AD1B
54 Hermaine Avenue
Dedham MA 02026

Phil Salas AD5X
1517 Creekside Drive
Richardson TX 75081

Richard L. Measures AG6K
6455 La Cumbre Road
Somis CA 93066

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of 73 Magazine, *and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or* 73 Magazine *for any equipment damage or malfunction resulting from information supplied in this column.*

Please send all correspondence relating to this column to its moderator at the address at top. All contributions used will be reimbursed by a contributor's fee of $10, which includes its exclusive use by *73 Magazine*. We will attempt to respond to all legitimate contributors' ideas in a timely manner, but be sure to send all specific questions on any particular tip to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

The other was that the TigerTronics Web site has a Windows shareware program available for download. Both ideas offered possible excellent solutions.

The deciding factor was that I had overspent my allotted hamming time for a visit that did not have extra time, so the solution would have to wait until my return home in a few days. It takes a supreme application of patience to sacrifice valuable ham time.

We made our way home; I had several catch-up projects in the mill. I got on those and downloaded the Windows program and let that sit for a day as I was still running a little behind.

The program, WINTNC11F, by Jon Welch G7JJF, proves to be a well written piece of shareware, but it only helped in that I could now say I had my hands on a Windows program that can be used with the BP-2M. This, however, wasn't helping the immediate problem.

Serial cable problem?

The old faithful 386 DOS machine surprised me by not finding the BP-2M when it was in place on the Comm port and the BPMODE program was searching for it. Obviously, to me, there had to be a cable problem with two adapters in place. Perhaps the wiring was taking a wrong turn in there?

After some experimenting, the BP-2M was installed on the Pentium desktop which has a 25-pin serial connector and suddenly, the room lit up with smiles as the computer spoke to the BP-2M in fluent computerese. That surely proved the problem was in the 9-pin to 25-pin lash-up I was using.

However, a new, one-piece adapter cable still wasn't the answer, so I called TigerTronics. After some discussion, the knowledgeable tech offered an idea I had overlooked. The 9-pin serial port for the mouse on the computer that was friendly to the BP-2M could be used to check the connection through the new cable to the modem.

It was necessary to restart the computer and not allow Windows 95 to start so a no-frills DOS could be accessed before the operating system started hunting for the mouse. With this hook-up, the BP-2M came to life through the new cable.

Further discussion revealed there are some 386s that cause this kind of grief. I am more concerned about the laptop. That is the desired home for the tiny BP-2M. Fortunately, the laptop is under warranty and IBM has a help line. I will get those two devices mated for portable packet work.

The BP-2M is quite a marvel. It looks to be about 1/20th the size by volume of the MFJ-1274 when it sits next to it. With it hastily mated to the Icom W2A and the signal fed to the roof-mounted yagi, the connection to the local PBBS is flawless. The BayPac packet software resembles most other DOS communications programs on the screen.

Plenty of good info at the fingertips

The diminutive system is capable of acting as a digipeater, offers file transfer and can handle up to eight ports open at once. With the 60-page operator's manual at hand, there is very little that cannot be accomplished with the BP-2M. It will certainly hold its own in packet operation.

Included in the package is a shareware multi-mode package, HamCom, designed to operate the BP-2M in AMTOR, RTTY and CW as advertised. I loaded the software and it has some very nice features that look like a fairly user friendly package. I will make a cable for the HF rig and give that a try when the dust settles from this last escapade.

Serial cable notes

Looking back on the cable activity, there are a few items I will pass along. There are of course, standards when adapting the 9-pin serial port to the 25-pin connector. Apparently, I was in too big a hurry to read all my tests accurately or I would have realized the adapters were not at fault. Although the TigerTronics tech advised me these adapters are always suspect and this was his first area of questioning. He advised that even when they check right, some have been known to leak between pins.

It takes some careful inspection of the cables and sockets to note the designated numbers on the pins before checking the connections through the cable with an ohmmeter. The BP-2M requires six of the available connections. Other modems and TNCs have differing requirements. For instance, the AEA PK232 needs all nine of them to function properly.

There are some packet modems that will get by with fewer than six. It is apparent there is no real need for the 25-pin connector for our needs. I see some listings on 25-pin to 25-pin serial cables for twelve wires. Though they are always available somewhere, I will include the proper 9- to 25-pin connections for your future reference (**Table 1**). When problems arise, it is one more place to check.

The digital world offers a lot of challenges. As you can tell, I spent more time on this project than I had allotted and it is still not finished. The laptop will need some help, but I am confident there will soon be one more portable packet station and of course there is the HF capability I have not yet explored. There's something special about new ham gear in the shack and overcoming the challenges it can present just make it that much more so.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO@N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO.

DB 9	DB 25
PIN 3	PIN 2
2	3
7	4
8	5
6	6
5	7
1	8
4	20
9	22

***Table 1**. Adapter pin-out.*

LETTERS

Continued from page 7

dengue fever and malaria. Anything that's on the side of the angels we want! It's difficult to get all the parts here but I managed to build a Bioelectrifier and my wife and I use it for 20 minutes each day as a prophylactic.

We are leaving here at the end of May to cruise Venezuela and points west. If we can get through the next six months without any tropical diseases I will consider it successful.

I thought your editorial was great—gold dust. We have been living that way for several years now—ever since I found out that old age wasn't something that happens with the passage of time; rather it is what you do to yourself by living wrongly.

Every word you say is true—keep saying it, even if only the more aware take notice. Far better to share the planet with them; the rest of the population will probably be watching TV anyway. Keep up the good work.

You might want to go to an hour a day when you think your blood is in trouble with a virus, parasite, etc. Hey, sailing around is a nice way to mark time through life, but what are you going to do to leave a little more of a mark than that on the sands of time? How about a traveler's newsletter about the places you've visited—the better inexpensive hotels, restaurants, etc.? You don't have to do the research, just ask the local hams and write that up. Who would know better? What kind of stuff should tourists look to buy that's special in that area? What is there to do? Scuba diving? Horseback riding? Fishing? What else? I'd be interested in a report on the hams on each of the islands—what bands they're on, how difficult is it for a visitor to get a license, are any of the local hams interested in letting visitors use their stations for a day or two while visiting the island? Any ham clubs? When do they meet? Any islands with 2m repeaters? ... Wayne.

ON THE GO

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/5
15475 Summerwood Avenue
Baton Rouge LA 70817

Back to school

As we approach September, school looms for many amateurs. Some are returning to the classroom themselves, while for others it's their children who are headed to school. This presents a number of ham-related opportunities and challenges.

Many college students return to campus and get set up in their dormitory (excuse me, residence hall) rooms. Some will wish to set up at least a small ham station, if that is permitted by the university. This could be as simple as a charging station and the handie-talkie, or something more comprehensive. The challenges faced in these situations are also faced by those who travel and wish to operate from a hotel room, and even for many who live in apartment complexes.

The first issue is power; most multi-unit facilities are woefully under-equipped with power outlets. Many dorm rooms, for example, were designed in the days when a student brought a reading lamp and an AM radio and two or three outlets were more than adequate.

Second is the radio frequency interference problem. When many people are sharing a common building, there is the very real chance that an appliance in the next room will interfere with many amateur frequencies. Hair dryers, for example, can sometimes create the most annoying sounds throughout the spectrum. Likewise, there is the potential for intermodulation interference if wireless phones are located throughout the building. Of special concern, especially in hotels, is the cable television service. Many cable systems utilize the two meter ham band frequencies. In theory, this creates no interference because the cable operators are required to keep their signals shielded. Unfortunately, as cable systems age, and as connectors loosen, the shielding becomes less reliable. In such cases, a two-meter handie-talkie can create a herringbone pattern on many of the televisions in the system. Although the cable system is at fault, the emphasis will be on eliminating the transmission rather than fixing the cable system.

Third, we all know a good ground is essential, especially if you plan to operate in the high-frequency range. However, unless you are located on the ground floor, the usual options, such as a cold water pipe, can create more problems than they solve. If the length of the pipe before it reaches an earth ground is a quarter wavelength or an odd multiple of a quarter wavelength, you will have RF hot spots at the rig.

Finally, there are the problems associated with an antenna, particularly if your intent is to operate in the HF frequencies. A proper antenna is big, clearly visible and out in the open, most of which are frowned on in temporary living accommodations.

Does this mean that you need to leave your hobby at home or in the car for the duration of your stay? Not necessarily, although successful operation may require a bit more ingenuity. First, plan to operate at relatively low power. This is not only practical, and good operating practice—it is also the law. A power strip (with its own circuit breaker, please) will help solve the electric outlet shortage problem, but don't forget that the available current may be less than 20 amps shared among several rooms.

Grounding can be accomplished in any number of ways. It is possible to cut a wire to tune the ground. Using a quarter-wave wire attached to the grounding post on the antenna tuner can alleviate this problem from a radio frequency ground perspective. To figure the length of the required radial, use the following formula:

The length of the radial in feet = 234 divided by the operating frequency in MHz.

For 20 meters, for example, the radial would be approximately 16 feet long. Don't forget this is an RF ground; you will still need a DC ground to prevent electrical shocks. This may be accomplished by a three-prong electrical plug if the transceiver has an internal power supply. If not, you can try attaching a wire to the center screw on the electrical outlet plate on the wall or a cold water pipe. Also, treat the radial as hot and keep it located so it can't accidentally come into contact with a person or heat up something flammable such as the carpet.

Many large apartment complexes, hotels and dormitories have steel frames. The bad news is that this blocks RF signals. The good news is *also* that it blocks RF signals. If you can get your antenna outside the window, your signal to the outside world will be better, and your signal to the other occupants of the building will be attenuated. For two meters, a J-Pole outside the building will normally be relatively unnoticeable while providing reasonable performance. For HF, wire antennas may be more appropriate. Don't automatically assume that your antenna must be of the stealth variety. It may be possible to get permission to install a small antenna on the roof of the building. A single-band vertical designed for mobile use with several quarter wave radials on a balcony or a dipole on the roof can provide acceptable results. Diplomacy and courtesy will go far in getting permission, if this is possible. Incidentally, I once spent months in a small apartment while on active duty for the Gulf War. My schedule was such that I really didn't have time to operate, although after getting off duty I wanted to listen to various broadcast and aircraft frequencies in the Middle East. I realized that the two-story building where I lived had an eaves trough which fed three downspouts. None of the metal touched the Earth. By connecting my rig to one downspout by means of very fine magnet wire, I was able to listen to the action unfold in real time. I was not comfortable using it as a transmitting antenna but it did a great job of receiving.

Finally, remember the cardinal rule of operating. When in doubt, filter, filter, filter. For HF operating, use a low-pass filter. If you are operating in a narrow band of frequencies, a band-pass filter may be appropriate. Your own television is probably closest to the transmitter and is most likely to pick up any RFI, so a high-pass filter on the cable in your room may be a big help. Just make sure that disconnecting the cable from the television doesn't set off a theft alarm at the front desk.

Feedback

I have enjoyed the response I've received on my first couple of columns. We hams are indeed communicators, and I've gotten messages via radiogram and E-mail as well as "snail mail." Ed Geis WB8IOE/4 shared an interesting idea, as we head into football season. When he was in the Dayton area, the Miami Valley FM Association would share scores from the various high school football games in the area. This information would be passed to the announcers who would read the latest score from a game being played elsewhere. Ed said this kept the hams in practice under conditions of noise, bad weather, etc. It also gave good public relations to the hobby since the announcer would point out that this information was being provided via amateur radio. Thanks, Ed.

In the future, I am planning a column devoted to many of the ideas that you have sent because some have been very interesting. 73

FREE

Wayne has a whole bunch of booklets you'll enjoy — like How to Make Money, The Bioelectrifier, WWII Submarine, Caribbean, and other Adventures, Editorial Collections, Instant Morse Code Course for the truly lazy, Reading Guide, Cold Fusion, and etc. Ask for FREE 16p list of WAYNE'S STUFF.
Order **Wayne's Stuff**

See page 88 for ordering info

Number 59 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

At the beginning of the summer, I highlighted a book published by Joerg Klingenfuss that helped the connected ham get information. Now, with Labor Day here already, Joerg has another offering for us.

Whether or not you think it's important, weather plays an integral role in our daily lives. Hams active on HF need to know about the ionosphere, and hams active in the community want information directly, without having to turn to the weathercaster on Channel 88.

The *Klingenfuss 1997/1998 Guide To Worldwide Weather Services* presents information on weather information available via a variety of radio modes, as well as the Internet, that is sufficient to satiate the worst weather junkie.

Within its over 400 pages, this 17th edition of the classic weather guide covers the spectrum of educational sites, such as the Automated Weather Source at [http://aws.com/], which sets up weather stations at schools throughout the United States; through country-wide sites like Macom, at [http://weather.macom.co.il/], which gives weather information for Israel and satellite photos of the Middle East; all the way to sites like the Climate Diagnostics Center, at [http://www.cdc.noaa/gov/], which is devoted to monitoring fluctuations of global and regional climate.

Besides covering the Internet, which is rapidly becoming the primary site for information interchange, the book also gives frequency and schedule information for a variety of Navtex, Radiofax, and Radiotelex sites worldwide. There are even crop calendars and jet stream data in this book.

With a total of 181 Internet sites, 110 Navtex stations, 64 Radiofax stations with schedules, and 91 Radiotelex stations, this comprehensive new compilation is a must-have for anyone interested in the latest weather information. It is available from Klingenfuss Publications for DEM60 (about US $36). You can write them at Hagenloher Str. 14, D-72070 Tuebingen, Germany; or visit the Internet site at [http://ourworld.compuserve.com/homepages/Klingenfuss/]. Whatever you do, don't forget to tell Joerg and company that you read about it here in RTTY Loop!

And speaking of high tech, I received a note from Buck Kidd W7LV/VQ9EK, who says he came across a Teletype Model 43 at a yard sale. Trying not to laugh, he found it's clean and it works. However, he needs one of the plastic paper guide bars which separate the incoming and outgoing paper streams. Typetronics, in Fort Lauderdale, used to carry all the parts a normal person could want ... even parts for his 35 RO, but there is no current telephone number available.

Well, gang, can anyone out there help Buck? If so, pass it along to me and I'll do my best to let him know.

On a more modern note, I often receive requests for a program to work with this or that terminal unit. This month, I would like to look at the latest offerings from Gary Johnson KF7XP, and his XPWare line. For DOS users, Gary has the following programs.

XPCOM Version 1.60: XPCOM is designed to support the PK88, PK232 and MFJ-278. For the AEA TNCs, all operations are performed in Host Mode.

XPDUAL Version 1.60: XPDUAL is specifically designed to allow dual port operation with the PK900 and DSP2232. Allows either full or split screen operation.

XPKAM Version 1.60: XPKAM Version 1.60 now supports version 8.0 firmware for the KAM and KAM+ and adds support for the KPC9612. Program supports the KAM, KAM+, KPC3, and KPC9612.

XPPTC Version 1.60: XPPTC is designed to work with the Paccomm PTC, SCS PTC and SCS PTCPlus. Requires version 2.0 or higher firmware.

XPPCI Version 1.60: XPPCI is designed to work with the HAL P38, PCI4000M, and DSP-4000 controllers. Supports all available modes. Also supports bi-directional binary file transfers in the background.

If that's not enough, check out his new Windows™ version, *XPWare for Windows (XPWIN) Version 1.1.8.* In Gary's words, XPWare for Windows is the latest program in the series. It offers support for AEA, Kantronics, SCS/Paccomm (PTC, PTC-Plus and PTC-II), and Hal (P38, PCI4000M, and DSP-4100) controllers. One program supports all controllers and the user may run one or two controllers at the same time (may be different types and brands). All controllers are run in their native host modes; this allows the most flexibility in the program.

The program also offers full transceiver control for most of today's HF radios. These include all Kenwood, ICOM, and Yaesu (FT-767, FT-840, FT-890, FT-900, FT-990, FT-1000 and FT-1000MP). The transceiver control section offers user-definable memories, scanning, quick store and recall of frequencies, band changes, etc. This is probably the most powerful transceiver interface in a program primarily designed for TNC control.

The program also supports DX Cluster monitoring. This allows the user to link to the cluster and, when a DX spot is received, the program will announce the callsign and frequency through a sound card (if installed). It also allows the user to "point and click" to the DX frequency (if transceiver interface is configured).

Full ANSI support is included, as well as a full host of new features that were not included in the earlier XPWare DOS program.

Among some of those features are Binary File Transfer capability including YAPP protocol for Packet, Restartable Binary File Transfer Protocol for Clover (PCC-compatible format), Restartable Binary File Transfer Protocol for GTOR and PACTOR, Automatic or Prompted Reception of Files, and Multiple Transmit File Queues.

All of this is yours to see via Gary's page, located at: [http://www.goodnet.com/~gjohnson/] or via the link on the RTTY Loop Home Page. The nice thing about this software is that it is classic shareware: Try it before you buy it. Full registration cost is $80; users of previous versions pay much less.

Finally this month, let's return to a recurring question. Mark C. Wilke, writes:

"A friend of mine recently bought a used AEA CP-1 at a local swap. We've been trying get it to work with HamComm with no luck. I wonder if you have any idea if there is something special we'd need to do to get HamComm to work with the CP-1 (the CP-1 has got the optional RS-232 interface) or is there something else we should be using. I saw the program called 'TUWIN' in collection #4 of your files. Perhaps that is what we should be using.

"Sure would appreciate any assistance you could give us. With AEA being unavailable to contact at this time, we can't even try them for the original software they offered."

Well, Mark, the bottom line on the CP-1 is that you can use it. Here's some other information, recently received, which should help you as well. Robert Creason passes along this information on the CP-1:

"Most of the AEA CP-1 and CP-100 TUs were shipped with only the C-64 interface installed. There was an optional kit sold by AEA for the standard RS-232 I/O. The manual shows the schematic of the circuit required for this RS-232 interface. The connector hole is already in the cabinet, and the PC board is etched for the ICs and other parts. I have installed one of the circuits in a CP-100 I once had and traded off

Number 60 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

Delays, delays ...

The wait for amateur radio's most ambitious satellite to date, Phase-3D, continues. Since the failure of the Ariane 501 booster last year, launch delays for the Ariane 502 flight have been numerous. P3D is ready, but nothing can be done till ESA, the European Space Agency, says go. ESA cannot afford another failure with the new Ariane 5 booster, and AMSAT groups around the world prefer a methodical, safe approach to the launch campaign. There is only one Phase-3D, and it is not insured. After insertion into orbit, the satellite will receive an OSCAR (Orbiting Satellite Carrying Amateur Radio) designator.

In the meantime, while we patiently (?) wait for P3D to be launched, there are many things to be done. The new satellite has frequencies and modes never seen on previous amateur radio spacecraft. While a well-equipped home station configured for the current hamsats will be ready for some facets of P3D, improvements and upgrades are needed to address the new features.

AMSAT, the Radio Amateur Satellite Corporation, has taken the initiative to develop publications to try to answer questions from both the experienced satellite enthusiasts and the newcomers. Two of the best are *P3G to P3D (The Provisional Preliminary Pre-Flight Guide to Phase-3D)*, edited by Paul J. Beckmann WA0RSE, and *Working the Easy Sats* by Gary B. Rogers WA4YMZ. Both are available at reasonable cost from AMSAT. The phone number is (301) 589-6062. If you have questions about prices or availability, just ask Martha at the AMSAT number, or send E-mail to martha@amsat.org.

P3G to P3D

The *Provisional Preliminary Pre-Flight Guide to Phase-3D*, or just *P3G to P3D*, is a first attempt to create a user's guide for a satellite that has yet to be launched. The first edition was published in April 1997, and contains up-to-date information.

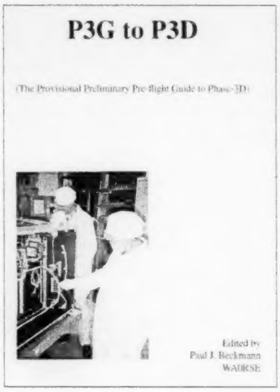
At the urging of AMSAT Executive Vice-President Keith Baker KB1SF, Paul Beckmann WA0RSE has collected articles and information about Phase-3D, augmented them with his own material and presented the compilation in a single volume. At just over 60 pages, this magazine-format offering provides all the basic information that a future Phase-3D user might need to begin planning and construction of a functional Earth station, and it's all in one volume.

Paul begins the book with a foreword and an introductory article explaining the guide's purpose, and providing the reader with some history to set the stage for the articles that follow. Other material by author/editor Paul provides the "glue" between the larger technical topics.

The first major article, "Phase-3D—A New Era for Amateur Radio" is packed with data about the satellite, its radio gear, the computer system, GPS (Global Positioning System) experiment, the Japanese SCOPE cameras, the power collection and distribution design, attitude control, propulsion units, space frame and thermal control. This submission from the Phase-3D Design Team, with its figures and tables, is a valuable overview of the spacecraft's components and functionality. While giving many general descriptions, the article also provides details down to exact frequency bandplans and expected receiver sensitivities and transmitter radiated-power figures.

Paul follows with two short features on the modes of Phase-3D and the use of computers in the shack. This leads into a detailed description of possible ground station equipment for use with the new satellite. Due to the higher frequencies that will be prevalent onboard Phase-3D, Paul provides ideas on the use of remote transmit and receive converters that can be mounted close to the antennas to minimize feedline loss.

The center section of *P3G to P3D* is a collection of photos and information tables covering the specifications and appearance of all the major transmitters and receivers in the spacecraft. Among the many novel experimental radios on Phase-3D is a receiver with an analog passband between 21.21 and 21.25 MHz built by Matjas Vidmar S53MV. Other bands covered include 145 MHz, 435 MHz, 1.26 GHz, 2.4 GHz, 5.65 GHz, 10.45 GHz and 24.048 GHz. Some bands have both transmitters and receivers, while others are specifically for uplink or downlink only.


P3G to P3D
(The Provisional Preliminary Pre-flight Guide to Phase-3D)
Edited by
Paul J. Beckmann
WA0RSE

Ed Krome KA9LNV has been active on the satellites for many years, primarily with home-brew gear. His article "The View from Below: Thoughts on Phase-3D Ground Station Requirements" goes a step further with plans for innovative stations for those interested in setting up a system for Phase-3D access. Ed's focus is on project ideas for home construction of antennas and commercial surplus radio conversions that can be pressed into service for the microwave transponders of Phase-3D. His own antenna system for every Phase-3D mode from 435 MHz up through 24 GHz fits on a single rotatable seven-foot boom.

Another ground station article from Frank Sperber DL6DBN provides the European point of view toward satellite modes and equipment choices. Frank adds information about the digital modes, link-margin calculations for the different bands and possibilities for transponder combinations. He points out that it is feasible to link the 21 MHz receiver to the 24 GHz transmitter, or anything else in between. It is also viable to activate multiple

---

(much to my regret)! However, I understand that the ICs required are no longer made now. The P/Ns are given in the manual. Might find some at one of the big hamfests. There are other ICs made now that can be used but would require a small PC board mounted inside the cabinet. This is a rather simple mod—almost anyone should be able to do it."

(I covered the modification in a previous issue of RTTY Loop; it is available on the Web home page for your benefit.)

Robert also passes along a few other points worth sharing. About the S/W for the Hal ST6000: "I have been using a program called BMK-MULTY that will work with most all the old TUs. The manual shows the hookup for the ST6000. I have used it with the CP-100 and now with an old AEA ATU-1000. It's the very best program for RTTY, AMTOR, PACTOR and CW that I have had, and it will give you SSTV also. It is sold by Schnedler Systems, P.O. Box 5964, Asheville NC 28813."

(I reviewed an early version of BMK software many years ago. I was impressed with it then, and I presume it has continued to grow over the years. Would be interested in others' experiences with this program.)

Well, as I mentioned above, the RTTY Loop home page continues to be a valuable resource for the radio amateur—both for the information it contains and the links it provides. As of this writing, we have had more than 10,000 visitors to the page. Check it out at: [http://www2.ari.net/ajr/recs/]. I look forward to your input, which has kept me going all these years. See you next month in the RTTY Loop! 73

Number 61 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Dayton Youth Forum '97

It was another terrific turnout at the HamVention Youth Forum this year. It's just so encouraging to see large numbers of adult hams come indoors on what was a beautiful day, to show their support for the youngsters. A big audience filled with supportive folks means a lot to all the children who do presentations at the convention.

With a great deal of behind the scenes machinations and lots of cooperation from the DARA people, we managed to pull off a really big surprise to open the forum. Ron Parese WA4SIR, one of the SAREX astronauts was brought to the Youth Forum as a big surprise to the audience.

Ron delighted the kids and adults in the audience by describing how he became involved in the space program and what it was like to be weightless. He spoke about the SAREX program, which is designed to encourage children to get interested in space science. As often happens in my own classroom when an astronaut is on the radio, many of the kids get nervous and forget their questions. But after a few moments everyone joined in the fun. What a treat for children to be able to ask questions of someone who has actually been in space. It was a great experience to have Ron speak with the audience for more than 20 minutes. I'm sure the kids will enjoy going home and telling their friends about it.

Photo A. SAREX astronaut Ron Parese WA4SIR, shown here with young forum speakers, was a surprise at the Youth Forum. Photo courtesy of Jim Ries WX8F, Dayton Amateur Radio Association.

My first young speaker was Mathew Karl KG2HV, age 12, an Extra Class ticket holder from New Hyde Park, New York. Mat belongs to LIMARC (Long Island Mobile Amateur Radio Club), whose large membership sponsors a Junior Operators division.

Continued on page 62

---

receivers with a single transmitter, or even multiple receivers to multiple transmitters if the satellite's power budget can take the load.

Paul finishes his guidebook to P3D with more data on the SCOPE cameras, a detailed bibliography for further research, a pictorial view of the satellite's orbit, a map of the Earth showing the origination points of the satellite's components and even a template for a fun, fold-up paper model of the largest, most ambitious hamsat ever, Phase-3D.

Working the Easy Sats

For newcomers to the amateur satellite program, the thought of building microwave gear to communicate through satellites thousands of miles out in space may seem daunting. For those that have been chasing the hamsats for many years, it's just another logical step and *P3G to P3D* is the key to moving on to new challenges. But when Phase-3D becomes operational, there will be many hams who would like to try their hand at space communications via the new satellite who have never listened for, or transmitted through, an amateur satellite.

When AMSAT-OSCAR-6 achieved orbit a quarter century ago, Mode "A" (two meters up and 10 meters down) seemed hard. Satellite tracking was not done with computers, and two-meter all-mode gear was mostly for experimenters and dedicated VHF enthusiasts. Today this mode is considered an entry point to hamsat operation.

Gary Rogers WA4YMZ has updated his popular 28-page booklet (stapled, 8.5" x 11" format) with contemporary information as of April 1997 (Revision 3.2). The publication details knowledge Gary has learned while setting up and operating his LEO (low-Earth orbit) satellite station. He says, "I did it. You can too. Come join the fun!" You may already have all the gear and antennas needed to listen for Dove-OSCAR-17 on two meters, make HF contacts through RS-12, talk to the cosmonauts on *Mir* with your two-meter FM mobile rig or work stations via the 70-cm FM repeater on *Mir*.

Gary's definition of an "easy sat" is a hamsat that is easy to hear, needs only simple ground station antennas and is easy on the finances. The book begins with a detailed table of contents, an introduction and an excellent frequency chart with operational notes of all the current amateur radio satellites. A glossary section follows, to illuminate all the acronyms associated with hamsat space communications.

The book continues with an explanation of the differences between amateur space communications and terrestrial activities. This section, titled "Special Considerations," addresses how to work through analog transponders, deal with Doppler, choose antennas and track the satellites.

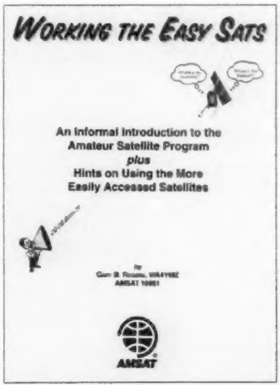
With all the preliminary information out of the way, detailed narratives follow on all the "easy sats": RS-10/11, RS-12/13, RS-15, Dove-OSCAR-17, Fuji-OSCAR-20, Fuji-OSCAR-29, AMRAD-OSCAR-27, *Mir*/SAFEX and the Shuttle's SAREX.

For those who would like to get ready for Phase-3D, but haven't worked the current fleet of hamsats, this is the place to start. Gary's information on the pursuit of the "easy sats" is accurate and carefully compiled. A newcomer armed with this manual should have no trouble getting a good beginning with this technology-oriented facet of ham radio.

The work concludes with thoughts on the digital satellites, Mode "B" (70 cm up and two meters down) on AMSAT-OSCAR-10, automatic tracking and tuning controllers, QSL cards, grid squares, certificates, a bibliography, AMSAT information and a complete description of Gary's home station.

Get both

The newcomer to amateur satellites needs to begin the hamsat quest with *Working the Easy Sats*. Even an experienced VHF/UHF enthusiast will have many questions about space communications when it comes time to actually make a contact via satellite. This book will answer them. With the pursuit of the "easy sats" complete, *P3G to P3D* will continue the process of getting ready for Phase-3D. Neither book will build your station for you, but the authors' insight will provide a map for your own successful configuration. 73



WORKING THE EASY SATS

An Informal Introduction to the
Amateur Satellite Program
plus
Hints on Using the More
Easily Accessed Satellites

by

AMSAT

***Photo B.** ARRL Hudson Div. Director Frank Fallon N2FF wishes Mat KG2HV and Carole good luck at the Youth Forum.*

Mathew described the many activities the young people have, including a weekly net that everyone is welcome to join. The youngsters have their own meetings where they plan their activities like a trip to the ARRL where they had a special tour and got to operate the W1AW station.

Mat showed slides of camping trips, bunny hunts, bike rides, and putting up antennas in the wild for contesting. The LIMARC members are to be commended for their tireless work and efforts with young adults in ham radio. If Mathew is an example of the kind of young ham that club is producing, our hobby is in good shape.

Mike Stutske KC8FOU is 14 years old. He spoke about having fun with friends on two meters. Mike had a really nice slide presentation where he showed us all the activities he and his dad do together in ham radio. He is responsible for getting other teen friends into the hobby. They all check in with each other every morning to plan their day.

Mike has also become an official weather spotter. He helps with communications at bike races and enjoys going to local hamfests. Mike feels that he and his dad get to spend lots of quality time together because of their mutual interest in the hobby.

At this point, Maria Harlan KC6ABM, sales support coordinator from Kenwood, came to the forum bearing gifts. She spoke briefly about the Kenwood newsletter that goes to clubs throughout the country. Kenwood has always been supportive of youth in ham radio. She distributed gifts to all the young people in the audience. We all congratulated Maria on getting her Extra Class license before coming to Dayton.

Joseph Von Bokern KB0YWT, age 12, and Nathan Wang KB0UQS, age 16, spoke next as representatives from one of my favorite clubs: BARC Jr., as sponsored by the Boulder Amateur Radio Club in Colorado. Two of the nicest and most talented hams I've ever met are Rip and Ellie Van Winkle, who are responsible for helping to organize and train the youngsters who come to my youth forum every year. The group was sweet enough to present me with a plaque with all the children's names on it who had been presenters at Dayton since 1993. What an impressive group!

Joseph had a terrific slide presentation showing the BARC Juniors having fun with foxhunting. He gave us some good tips about finding the hidden transmitter, and did it all with great humor. His fellow club member Nathan did an excellent job describing slides showing adventures in Field Day and contesting. He described HF night at Ellie and Rip's house where he got to speak with people he knew from other states. Nathan especially likes the way you can meet so many interesting people on the radio. He thinks that showing kids the fun on HF has led many of their club members to getting higher licenses. It's always a pleasure to meet with the young people from this highly productive club. Thanks for everything, Ellie.

It wouldn't seem like my youth forum was complete without the appearance of one of our staunchest supporters—Chris Lougee, National Sales Manager from ICOM. For the last 10 years, ICOM, and Chris, in particular, for most of those years, have been contributors to my youth forums across the country. This year one lucky child in the audience was the winner of an IC-T2A handheld transceiver. Special thanks to Chris and all the nice folks at ICOM.

Kathy Gilliland KB0FDU from Hiawatha, Kansas, is a former speaker from a previous youth forum. She's all grown up now and gave a talk about ham radio and career choices. She herself works for a local radio broadcasting station where she lives. She feels ham radio provided invaluable experience in being comfortable behind a microphone.

Richard Stubbs KC5NSZ from MFJ customer service has been supporting the youth forum for many, many years. He appeared this time with Mr. Jue, the founder of MFJ and Nick Smith from *Amateur Radio Trader*. Nick announced a contest which would begin in the August issue. A cartoon character named Art would go on a DXpedition to several locations. Clues would be given as to where he was. MFJ gave $10,000 in prizes for the contest.

Martin Jue *(seen on this month's cover)* was given a bit of a surprise when my audience stood and sang Happy Birthday to him for the 25th anniversary of MFJ. Congratulations to a fine gentleman! Richard then gave away several nice gifts including a Morse Tutor, a new MFJ product. He donated one to my school. I'll be sure to give my readers a review. Let's remember to support all the manufacturers who are actively lending support to recruitment efforts to get qualified young people into ham radio.

The last presentation was from a talented group of students from Hook Elementary School in Troy, Ohio. They got to speak with astronaut Nancy Decker Curie on the all-Ohioan crew aboard the Discovery telebridge SAREX contact last year. Teachers Ed Latta KA8CBE and John Gibbons KB8OFS introduced Derek Gibbons KB8YTL, Danny Ojeda KB8ZU and Matt Penneybacker KC8BGF, who spoke about their school contact with STS-70. These children's excitement as they described the preparation into teams for the contact, their questions to the shuttle, and their meeting afterwards with Nancy Curie, seemed a fitting ending to a forum which had begun with a visit from an astronaut. Only in ham radio!

***Photo C.** The Elmers with Nathan KB0UQS (left) and Joe KB0YWT (right) from Boulder, Colorado.*

Radio Bookshop **Radio Bookshop**

Phone 800-274-7373 or 603-924-0058. FAX 603-924-8613, or see order form on page 88 for ordering information.

Rene's Books

NASA Mooned America. René makes an airtight case that NASA never landed anyone on the moon. Ridiculous, of course, so maybe you can be the first to find fault with René's 30 "gotchas." He sure convinced Wayne. $28.

The Last Skeptic of Science. René blows holes in one cherished scientific dogma after another. Do you believe there have been ice ages? That the moon causes the tides? That the iron core of earth causes its magnetic field? That the transmutation of elements is difficult? Another $28 well spent.

World's Fastest Code Course

The old, hard way, to learn the code is to start slow and gradually speed up. In that direction lies madness. The Blitz Method is to start at 13 or 20 wpm immediately. Yes, tapes are available to help. Use T-5 to learn the characters. T-13 will get your General ticket with a few hours work. T-20 ditto for Extra. The tapes are $7 each and are as nasty as Wayne could make them.

NEVER SAY DIE

Continued from page 48

The *Dilbert* books have my laugh ringing through the house. Scott Adams is a genius.

Then there's P. J. O'Rourke, who lives down in the next town here in New Hampshire. Don't miss his books or listening to him talk. Hey, if you catch a talk of his on radio or TV, please tape it and send me a copy so I can enjoy it. Ditto Scott Adams.

Say, if you run across any books or even TV shows that I may have missed, let me know. I do have a section in my guide to books you should read on the most outstanding humor books I've read—like by Stephen Potter, Benchley, Thurber, and H. Allen Smith. I'd love to find new additions—how about it?

DVD

I hope it's no news flash to you that we're going to be seeing an increasing flurry of digital video discs. They're the same size as CDs, but they hold over nine times more data, which has made it possible to put a whole movie on a single disc. They crammed the additional data on the discs by making the pits nine different depths instead of just one. With movies this will enable them to add different endings, sound tracks in several languages, comments on the production, and other trivia.

The discs will be lower-priced than video tape, so as players come down in price we may see the movie renting public buying the new players. The pictures will be much better than on tape, and you don't have to fast-forward or rewind to find something. No, you can't yet record your own.

Judging from the ubiquity of video rental stores, I'm one of the few people who doesn't rent movies. Or buy them, either. I go to the movies every week or so, and catch a few of those I miss in PrimeStar. I haven't missed very many good movies, but I sure have watched a bunch of turkeys.

I can't think of any good reason for me to get a DVD player yet. Heck, Sherry bought a video disc player and we've never used it. I do keep my VCRs busy. I rarely watch any shows live, preferring to time-shift them for my convenience and so I can skip through the commercials.

Pesticides

The marvels of modern chemistry have made it so bugs won't attack sick crops. If you've read much about plants you know that insects tend not to attack healthy plants. But with the minerals in most of the world's soil completely exhausted, and crop growth only possible through the use of chemical fertilizers, farmers have to spray the heck out of their crops to keep insect damage under control. And you, oh trusting consumer, are buying these well-sprayed chemically-grown foods and raising the devil with your body when you eat them.

A good washing will generally get rid

Continued on page 80

- DIP switch programmable
- CTCSS encoder
- All 32 EIA tones from 67.0 - 203.5hz included
- May be ordered with custom tones

SS-32PA Encoder
.9" x 1.3" x .4"

SS-32PA DIP Switch Programmable CTCSS Encoder $28.95

- Fully enclosed CTCSS encoder
- All 32 EIA tones from 67.0 - 203.5hz included
- Perfect for mobile / base applications

TE-32
5.25" x 3.3" x 1.7"

TE-32 Multi-Tone CTCSS Encoder $49.95

TP-3200 Shared Repeater Tone Panel

- 51 CTCSS Tones
- 106 DCS Codes
- Supports 157 Repeater Subscribers
- On-Line Computer Help
- Repeater CW ID
- Air Time Loading & Analysis Graphs
- Signalling Formats: CTCSS DCS & DTMF

TP-3200D Table Top Version $269.95 each
TP-3200RM-A Single Rack Mount version $279.95 each
***TP-3200RM-B Triple Rack Mount version $279.95 each**
*Holds up to three TP-3200s

- Eight programmable, selectable messages
- Fully field programmable via included keypad
- Meets all FCC identification requirements

ID-8 Automatic Morse Code Identifier
1.85" x 1.12" x .35"

ID-8 Automatic Morse Station Identifier

NEW LOWER PRICE $69.95 ~~$89.95~~

Call or write to receive our full Product Catalog

MasterCard VISA

COMMUNICATIONS SPECIALISTS, INC.
426 WEST TAFT AVENUE • ORANGE, CA 92865-4296
(714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. (800) 854-0547 • FAX (800) 850-0547

CIRCLE 10 ON READER SERVICE CARD

CALL TOLL-FREE
(800) 292-7711
Se Habla Español

C&S SALES
EXCELLENCE IN SERVICE

CALL FOR A FREE 60 PAGE CATALOG!
(800) 445-3201

AFFORDABLE, HIGH QUALITY ELENCO OSCILLOSCOPES
2 YEAR WARRANTY

STANDARD SERIES
S-1325 25MHz $325
S-1340 40MHz $475

Free DMM w/ any Elenco Scope ($20.00 value)!!

DELUXE SERIES
S-1330 25MHz $439
S-1345 40MHz $569
S-1360 60MHz $749

Features:
- TV Sync
- 1mV Sensitivity
- X-Y Operation
- High Luminance 6" CRT
- Complete Schematic
- Plus much, much more!!

2 FREE probes with each scope!!

Features:
- Delayed Sweep
- Automatic Beam Finder
- Z Axis Modulation
- Dual Time Base
- Illuminated Internal Gradicule
- Built-in Component Test
- Plus all of the features of the "affordable" series!!

MX-9300
Four Functions in One Instrument
Features:
- One instrument with four test and measuring systems:
  - 1.3GHz Frequency Counter
  - 2MHz Sweep Function Generator
  - Digital Multimeter
  - Digital Triple Power Supply
- 0-30V @ 3A, 15V @ 1A, 5V @ 2A

$479.95

B&K 4040 w/ Frequency
- 2Hz to 20MHz
- AM and FM Modulation
- Linear and Log Sweep
- Counter Range 5Hz to 30MHz
- 5 Digit Display

$425

GF-8026 w/ Frequency
- .02Hz to 2MHz
- Linear and Log Sweep
- Counter Range 1Hz to 10MHz
- 4 Digit Display

$225

Model XP-581
4 Fully Regulated Power Supplies In One Unit
4 DC voltages: 3 fixed - +5V @ 3A, +12V @ 1A, -12V @ 1A • Variable - 2.5 - 20V @ 2A

Ideal for laboratories, service shops and hobbyists.

$85

Fluke Multimeters

70 Series	
Model 70II	$74.95
Model 73II	$97.50
Model 75II	$135.00
Model 77II	$154.95
Model 79II	$175.00
80 Series	
Model 83	$235.00
Model 85	$269.00
Model 87	$289.00

Model M-6100
Programmable DMM
Includes FREE Computer Interface and FREE Software
- Analog Bar Graph
- Large 3 3/4" LCD Display
- Menu Driven
- Triple Display
- RS-232 Interface
- True RMS
- 9 Basic Functions including cap. & freq.
- Auto Power Off
- Easy-to-use

$125

B&K Model 1688
High Current (25 DC amp) Power Supply
- Variable 3-14VDC
- 25 amps @ 135V
- Thermal Protection

$249.95

1.3GHz Universal Counter
Model F-1300
- Period
- Frequency & 8 other functions

$225

M-1700
Digital Multimeter
11 functions including freq to 20MHz, cap to 20µF. Meets UL-1244 safety specs.

$39.95

XK-550 Digital / Analog Trainer

Elenco's advanced designed Digital / Analog Trainer is specially designed for school projects. It is built on a single PC board for maximum reliability. It includes 5 built-in power supplies, a function generator with continuously sine, triangular, and square wave forms. 1560 tie point area.

XK-550 Assembled and Tested
$169.95
XK-550K - Kit
$139.95
Tools and meter shown optional

Kit Corner over 100 kits available

Model AR-2N6K
2 meter / 6 meter Amateur Radio Kit
$34.95

Model AM/FM-108
AM/FM Transistor Radio Kit
$29.95

Model M-1005K
Low cost, 3 1/2 digit LCD, 18 ranges, transistor test, diode test, overload protection and pocket size.
$19.95

Model TR-18K
Stereo Cassette Player Kit
- Transparent case
- High resolution

$15.95

WE WILL NOT BE UNDERSOLD
UPS SHIPPING: 48 STATES 5%
OTHERS CALL FOR DETAILS
IL Residents Add 8.25% Sales Tax

C&S SALES
150 W. CARPENTER AVENUE
WHEELING, IL 60090
FAX (847) 541-9904 (847) 541-0710

15 DAY MONEY BACK GUARANTEE
FULL FACTORY WARRANTY
PRICES SUBJECT TO CHANGE WITHOUT NOTICE
http: www.elenco.com cs sales

CIRCLE 184 ON READER SERVICE CARD

Communications Simplified, Part 21

Peter A. Stark K2OAW
P.O. Box 209
Mt. Kisco NY 10549

Everyone knows that you need a modem to send digital data through a telephone line. That piece of conventional wisdom turns out not to be entirely true. You can send a lot of stuff through a telephone line, without a modem—even high-speed digital data or video, if you do it right. We will discuss modems in a moment, but first the big picture.

POTS

POTS is the abbreviation for the *Plain Old Telephone System*—also sometimes called PSTN for *Public Switched Telephone Network*. **Fig. 1** shows a very simplified diagram of the overall system.

Your home telephone has a microphone (also called a *transmitter* in telephone lingo) and an earphone (called a *receiver*), which convert between sound and electrical signals. These connect to the telephone line through a *hybrid*.

More details on the hybrid later; for now, we need only say that the hybrid interfaces the two one-way or *simplex* connections (to the earphone, and from the microphone) to the two-way or *duplex* telephone line which leads to the telephone company's *central office*.

The telephone line, called the *local loop*, is a *twisted pair*—a balanced line consisting of two thin conductors (typically 24-gauge) which are twisted together to reduce interference—which connects between your telephone and the central office. It is important to remember that this line carries voice simultaneously in both directions.

At the CO, another hybrid splits the two-wire two-way local loop back into two one-directional connections. The outgoing signal is converted from analog to digital, and stays digital all the way until it gets to the central office at the far end. The boxes labeled "Digital channel" in **Fig. 1** could be made up of copper cables, optical fibers, microwave relays, or even satellite links.

Because the conversion to and from digital form is done at a sampling rate of 8000 Hz, anti-aliasing filters in the system cut off all audio above roughly 3500 Hz. This is fine for audio, but doom for pure digital signals—it means that digital pulses, which tend to consist of square edges with plenty of harmonics, have no chance of getting through the system without some help.

The modem

With the above background, you can now understand the function of the modem. The modem (whose two main components are a *mod*ulator and a *dem*odulator—that is where it gets its name) takes the digital data and disguises it to look like sound. In simple terms, it takes the digital data and modulates it onto an audio carrier at one end of the connection, and then demodulates it at the other end back into digital data. Temporarily converting it into audio keeps the telephone circuits happy.

It's useful to trace the development of modems to understand the techniques they use.

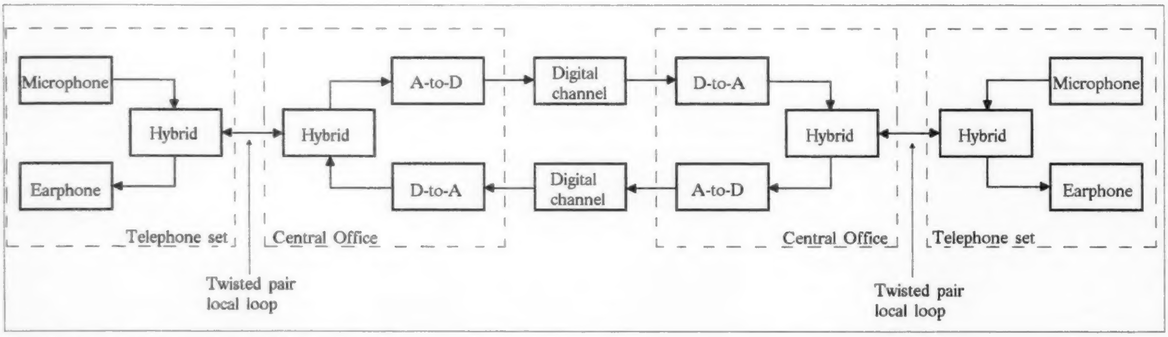


Fig. 1. Signal path through the POTS network.

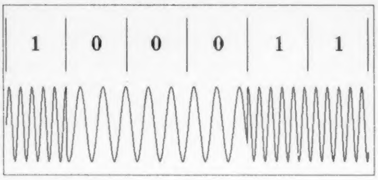


***Fig. 2.** Frequency-shift keying (FSK).*

The Bell 103 modem

Up until the mid-1970s, only telephone companies ("telcos") were allowed to connect equipment to phone lines. Early modems were therefore identified by the model numbers assigned to them by the telcos, usually part of the Bell System. The model 103 was the first commonly-available modem, useful for carrying data up to 300 bits per second (bps). It modulated the digital data onto an FM carrier, with a different carrier frequency used in each direction.

Because the digital data only has two values—a 0 or a 1—the FM carrier, rather than continuously deviating back and forth over some range, jumps back and forth rapidly between two frequencies—a high frequency (which represents the digit 1) and a low frequency (which represents a 0). Since the carrier jumps (or "shifts") back and forth between them, the modulation method is called FSK or *frequency-shift keying* rather than just FM. You can consider it as plain FM with a square-wave modulation; since the square-wave modulation has a fundamental and many harmonics, there are multiple sidebands on both sides of the carrier. But the higher harmonics of a square wave are progressively smaller, so the sidebands farther from the carrier frequency drop off rapidly.

Fig. 2 illustrates what FSK looks like—a few cycles of a high frequency for a 1, and a few cycles of a low frequency for a 0. (The figure also shows a problem that has to be avoided in normal use. Note how the signal has sharp edges between adjacent bits; these edges cause clicks and interference. In an actual FSK signal, the signal has to maintain *phase continuity*; that is, it has to smoothly and continuously blend from one frequency into the other.)

The 103 modem was *full duplex*, meaning that it allowed signals to go in both directions at the same time. (A mini-detour at this point: *Half-duplex* transmission also goes in both directions, but only one direction at any one time—the two modems in the connection must take turns sending to each other. *Simplex*, on the other hand, allows transmission in only one direction.)

To avoid interference, full duplex in the 103 modem required two separate carrier frequencies, one in each direction. The modem which placed the call (called the *originate* modem) sent out a carrier frequency of 1170 Hz with 100 Hz deviation up and down; the carrier frequency thus shifted back and forth between 1270 Hz (1170 plus 100) for a 1 and 1070 (1170 minus 100) for a 0. (Note that, since only the digits 0 and 1 are possible in the digital data, only the frequencies of 1070 and 1270 Hz are allowed for the carrier. In other words, the carrier frequency never actually became the 1170 Hz center frequency.) The *answer* modem at the other end used the same 100 Hz deviation, but sent out a center frequency of 2125 Hz; its output was therefore 2225 Hz for a 1 and 2025 Hz for a zero. **Fig. 3** thus shows an originate modem—1070 and 1270 Hz are sent out, while 2025 and 2225 Hz are received.

The sidebands depend on the actual digital data being sent, but typically extend about 600-800 Hz on each side of the carrier. The originate modem's signal therefore occupies the range from about 300 to about 1800 Hz, while the answer modem's sidebands range between about 1500 to about 3000 Hz. You'll note that the sidebands interfere with each other in the middle range of 1500-1800 Hz between the two carriers. Fortunately, the sidebands farther from the carrier drop off rapidly with square-wave modulation, which helps to reduce the interference somewhat. Still, the signal leaving each modem does interfere somewhat with the incoming signal.

Unfortunately, there is another effect which also comes into play. Since each carrier may have to travel through a lot of circuitry on its way from one modem to the other, the outgoing signal from the modem is much stronger than the incoming signal, typically by 20 dB or more. The outgoing signal therefore interferes with the incoming signal, which the modem's demodulator is trying to receive. The effect is somewhat like trying to hear someone far away while someone else is yelling into your ear. The fact that the incoming and outgoing sidebands overlap to some extent makes things even worse.

As shown in **Fig. 3**, the modem has two circuits which try to solve the problem—a filter, and a *duplexer* (which is just another name for the hybrid). The filter passes mainly the frequencies to be received, and tries to eliminate the outgoing signal (as well as other noise picked up on the phone line) from getting into the demodulator. But because the outgoing and incoming sidebands interfere in the middle frequencies, the filter cannot completely eliminate the outgoing signal without also removing some of the incoming signal.

That's where the duplexer/hybrid comes in. We have already mentioned that a hybrid acts as an interface between one two-way circuit (which typically requires two wires) and two one-way circuits (which typically have two wires each, so together they need four wires). The name duplexer comes from its ability to combine two simplex signals into one duplex signal.

But it does more than that. It also acts as a one-way valve, letting the outgoing

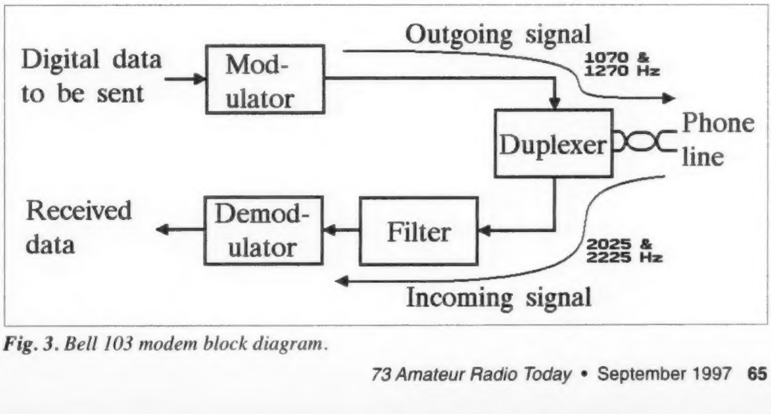


***Fig. 3.** Bell 103 modem block diagram.*

signal go from the modulator to the phone line, letting the incoming signal go from the phone line to the filter and demodulator, but preventing the outgoing modulated signal from taking the shortcut down to the filter.

Telephone company people call their duplexer a hybrid, primarily because their circuit uses a combination of a transformer, capacitor, and resistor (and a few other components). **Fig. 4a** shows the telephone hybrid used in many older telephones. Although **Fig. 4a** shows two transformers, actually there is only one transformer because all five of the windings are wound on one common core. An incoming signal from the telephone line flows through the four upper windings (which all act as one big primary), and then through the transformer to the earphone. You thus hear the person at the other end of the line.

When you speak, however, the outgoing signal from the microphone comes in at the center of the top four windings, and splits in half—roughly half of the microphone audio signal goes right to the phone line, while the other half goes left to resistor R and capacitor C. Because the currents go in opposite directions, they cancel in the transformer, and very little of the signal gets sent to the earphone. You hear your own voice, but not very loud.

In order for the microphone current to split in half, with equal parts going right and left, the impedance on the right and the impedance on the left must be equal. Resistor R and capacitor C are thus chosen so that their series impedance is approximately equal to the impedance of the telephone line; they are sometimes called a *balancing network*. If R and C were chosen exactly right, the mike currents going right and left would exactly balance each other, and you would hear none of your voice in the earphone at all. This is hard to achieve, because every telephone line is slightly different and requires slightly different values of R and C. In any case, complete canceling of your voice from your earphone is not desired—most people like to hear a bit of their own voice to convince themselves that the telephone is working! So, in an actual telephone, R and C are intentionally slightly off to produce a slight amount of what is called *sidetone*—the feedthrough of the mike signal into the earphone.

Fig. 4b shows a more solid-state version of the hybrid (and there are other versions, too). As before, resistor R and capacitor C are a balancing network whose impedance should be equal to the phone line. The outgoing signal from the modulator, coming in at the left, is split in two. Part of it goes through resistor R_a to the balancing network, while the other part goes through resistor R_b (and a transformer) to the phone line. Resistors R_a and R_b are equal; if the impedance of the balancing network is the same as the impedance of the telephone line (as seen through the transformer), the voltages at the + and - inputs to the op amp will be equal. An op amp amplifies the *difference* between its two inputs, but there is no difference between them and so the amplifier amplifies nothing. So none (or, at least, very little) of the outgoing signal gets from the modulator into the demodulator.

The incoming signal from the phone line, on the other hand, goes directly through the transformer to the + input of the op amp, where it is amplified and sent to the filter and then the demodulator.

Because you want sidetone in a normal phone, the hybrid circuit inside the telephone is intentionally not completely balanced; that is, the RC balancing circuit is intentionally slightly misadjusted. In a modem, on the other hand, the situation is reversed—you must eliminate the sidetone as much as possible to avoid confusing the demodulator. Still, it is not possible to manufacture a modem with the precisely exact values of R and C for every possible situation.

Returning to the 103 modem, it is now clear that some of the outgoing signal from the modulator will get back into the demodulator and cause interference. Combined with any external noise and interference coming in from the telephone line, this makes it harder for the demodulator to correctly identify the incoming frequency.

If you look at **Fig. 2**, you will note that the difference between the high frequency and the low frequency in that FSK signal is fairly obvious. But this figure exaggerates the difference because it uses a 2-to-1 difference in frequencies. The actual difference between the two frequencies in a 103 modem was less than 20% for the low tone, and less than 10% for the high tone. If **Fig. 2** showed such a small difference, you would have a hard time telling the difference by eye. The demodulator has the same problem; it therefore needs several cycles of a tone before it can reliably tell whether it has a 1 or a 0, and this effect limits the bit-per-second rate that the modem can handle. As a rough rule, these modems needed about two or three milliseconds of a signal before they could correctly identify the signal; this therefore set the shortest bit-time at 2 or 3 ms. In this way, we can see that the fastest modem speed was somewhere in the range of 333 to 500 bps. Since the two nearest common bps rates used at that time were 300 or 600 bps, these modems could clearly work at 300 bps or slower, but not at 600 bps.

One way to speed up operation is to make the difference between the low and high frequencies greater, so that fewer cycles of a signal would be needed to tell them apart. This led to the Bell 202 modem, which used 500 Hz deviation on a 1700 Hz carrier; the FSK therefore shifted the frequency to 1200 Hz (for a 1) and 2200 Hz (for a 0). This speeded

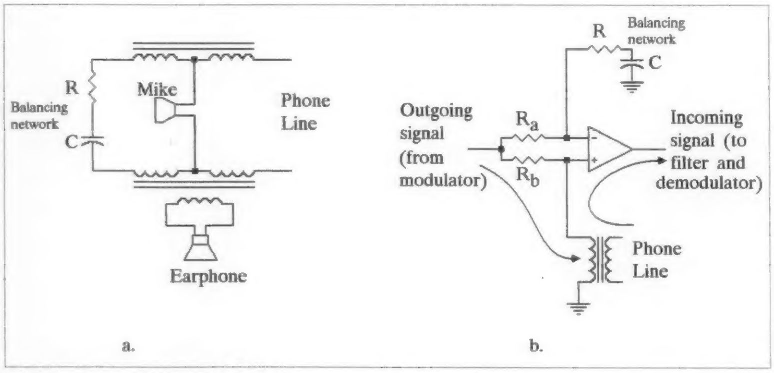


Fig. 4. The hybrid/duplexer circuit.

up operation to 1200 bps, but used up the full bandwidth of the phone line. As a result, the modem could only be used in one direction at a time; it was therefore a half-duplex device.

DPSK modems

Once it became legal to connect your own modem to a telephone line, modem design changed from a Bell monopoly to a free-for-all, with many companies using incompatible methods to increase speeds. Gradually, a set of standards was developed by the CCITT (The Consultative Committee for International Telephony and Telegraphy, which is now called the International Telecommunications Union—Telecommunications Sector or ITU—T.) The progression of modem speeds is shown in the listing of standards (the letters bis and ter refer to the second and third revision of a standard):

V.21: 300 bps
V.22: 1200 bps
V.22bis: 2400 bps
V.32: 9600 bps
V.32bis: 14,400 bps
V.32ter: 19,200 bps
V.34: 28,800 bps
V.34Q: 33,600 bps

Modems up to 1200 bps used the older, simpler techniques we discussed in the previous section. Significant speed increases came later, with the development of differential phase-shift keying or DPSK.

Instead of changing the frequency, DPSK modems change the phase of the carrier. **Fig. 5** shows a simple example. Suppose we agree that

0 is a 0° phase shift, and
1 is a 180° phase shift.

We start off with a carrier, and for each bit change the phase (from the previous bit) by 0° for a zero, and 180° for a one. This will give us the waveform in **Fig. 5**. Since a 0° phase change is no change at all, we only see the phase change (by 180°) at the beginning of each 1. It's clear what PSK means in this context; the D in DPSK means that the phase changes not from some fixed reference, but from the previous bit; it is the difference between consecutive bits.

Since this system has two possible phase changes, it is called a DPSK-2 system.

Let's now consider a slightly more complex example, called DPSK-4 because there are four possible angles, defined as follows:

00 = 270°
01 = 180°
10 = 90°
11 = 0°

To use this, we will divide our data (100011 in the prior examples) into groups of two bits called *dibits*—10, 00, and 11—and then send each dibit on its own portion of the signal; that portion will be called a *symbol*. We encode each group of two bits onto its symbol by changing the phase angle of that symbol according to the above table. For these six bits we have:

10 = 90°, which means go forward 90°, or skip forward 1/4 of a cycle;

00 = 270° means jump ahead 45°. This is equivalent to -90°, which tells us to go back 90°;

11 = 0° means no change in phase.

The result is the signal in **Fig. 6**, where we have shown the -90° phase change at the beginning of the 00 dibit, and also noted that the phase does not change for the 11 dibit. (If you look carefully, you can also see the +90° phase change at the beginning of the 10 symbol, as well as another change at the far right, after the 11 dibit's symbol.)

Figs. 5 and **6** bring up an important concept. Suppose the bandwidth of a circuit is such that we can only change the signal's phase 600 times per second; i.e., we can only send 600 symbols per second. If we used the simple scheme of **Fig. 5**, then each symbol would only carry 1 bit, and therefore we would also be limited to 600 bits per second. But using the scheme of **Fig. 6** lets us pack *two* bits into each symbol; we can therefore send 1200 bits per second, instead of 600. We have thus doubled the amount of data that can be sent through the phone line in each second.

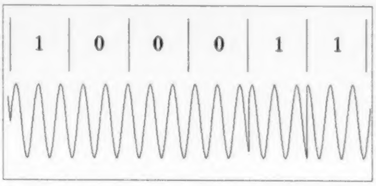


Fig. 5. DPSK-2 with two phase angles.

Let us now define a very misunderstood term: *Baud rate*. The baud rate is the number of symbols (or signal changes) per second. It is misunderstood because many people think that "baud rate" means "bit-per-second rate," which is true only in very simple cases.

Look at either **Fig. 2** or **Fig. 5**. In both of these cases, each symbol carries at one bit. In this very simple case, the number of symbols per second is also equal to the number of bits per second. So the baud rate is equal to the bps rate. But look at **Fig. 6**—here each symbol carries two bits. Hence the bit-per-second or bps rate is actually *twice* the baud rate!

Because of the limited bandwidth of the common telephone line, modems are limited to about 3000 symbols per second or 3000 baud. What is commonly advertised as, for example, a "9600 baud modem" actually generates a 2400-baud signal which crams 4 bits on each symbol to give an effective rate of 9600 bps. The same idea holds for faster modems.

The term baud rate is misused so often that it has become common to refer to the bps rate as the baud rate. But you should remember the difference because, every now and then, some stickler for accuracy (like a teacher or college professor) will try to trip you up on the difference.

The information we have tabulated so far as

00 = 270°
01 = 180°
10 = 90°
11 = 0°

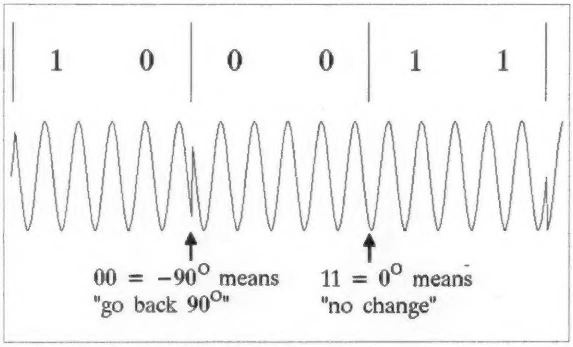


Fig. 6. DPSK-4 with four phase angles.

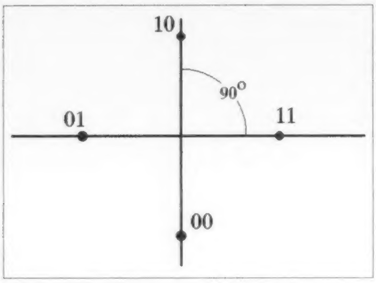


Fig. 7. A DPSK-4 constellation diagram.

can be shown in a slightly different form called a *constellation diagram*, **Fig. 7**. Imagine that each of the four different angles is a vector whose angle indicates the phase angle, and whose length represents the amplitude of the corresponding symbol (all the vectors in this example would be the same length, because the amplitude of the DPSK signal is constant—so far). To reduce the clutter, though, we simply put a dot where the end of the vector should be, rather than drawing a full arrow. For example, the dot at the top represents a vector at 90° (angles are measured from the right axis, just as in normal math). Each dot is labeled with its corresponding bit pattern, so the one at 90° is labeled 10. The constellation diagram is merely a more compact way of listing the same information as the previous table.

The reason for using constellation diagrams is that they let us show how faster modems really work. For example, a fairly simple 9600 "baud" modem (which is really a 2400-baud modem, working at 9600 bps because each symbol carries four bits) has the constellation diagram shown in **Fig. 8**.

QAM

Quadrature Amplitude Modulation or QAM is the basis of all modern high-speed modems. **Fig. 8** is a very simple example of QAM, which is a combination of differential phase shift keying (DPSK) and amplitude shift keying (ASK).

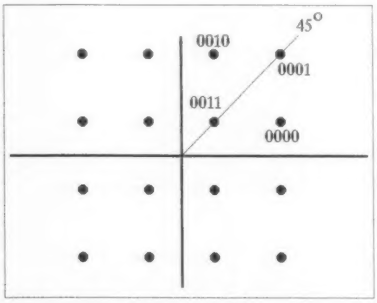


Fig. 8. 9600-bps DPSK-16 modem.

As we see in the figure, the constellation chart of this 9600-baud modem has sixteen dots. Each dot carries four bits (since 2^4 is 16), so 2400 symbols per second—2400 baud—will carry 4 x 2400, or 9600 bps.

All together, the sixteen dots appear at 12 different phase angles. But note also that the dots are not all equal distances from the center of the chart. Remember that each dot simply represents the tip of a vector; the direction of the vector shows the phase angle of the symbol, while its length shows its amplitude. For example, the dots that carry 0011 and 0001 are both at an angle of 45°, but 0011 has a small amplitude, while 0001 has a large amplitude.

This method therefore combines phase-shift keying and amplitude-shift keying to provide the 16 different symbols needed to permit a fairly high bit-per-second rate, while still keeping the baud rate—the actual number of different symbols in each second—within limits.

But there is a price to pay—with two different phase shifts as in **Fig. 5**, the difference between any two successive symbols is either 0 or 180 degrees, and it is fairly easy to tell the difference between them. With the 12 different phases of **Fig. 8**, and three different amplitudes, there is only about a 30-degree difference between the various phases. Add some noise, and possibly even phase differences introduced by the telephone line, and you can see that a modem's demodulator can easily make mistakes.

Now imagine that we want to extend this idea to faster modems. For example, suppose that we just double the speed to 19,200 bps. Still being limited to 2400 baud, we must pack 6 bits on each symbol. Now there must be 2^6, or 64 different dots in the constellation chart. If we use three different amplitudes, there will be 32 different phase angles. You can see that this would greatly increase the modem's error rate, probably making it unusable. So something else has to be done.

DETOUR

Before continuing, just a quick detour to explain the word quadrature in quadrature amplitude modulation.

In math, quadrature means "at right angles." But the angles in DPSK are not 90°, so why is it called quadrature?

In math, a sine wave and a cosine wave look the same, but they are shifted 90° apart; they really are in quadrature. If you add a sine wave to a cosine wave of the same frequency, you get a new signal which looks just like a sine wave, but is offset by some new phase angle. The modem's modulator produces the 12 different phase angles in **Fig. 8** by adding various amounts of the quadrature sine and cosine signals together.

END OF DETOUR

Modern modems

So how do modern 28k or 33k modems achieve their remarkable speed and performance? By using a number of tricks. Some of these involve fairly complex math, so we will only give a brief qualitative description, without any of the mathematical detail.

Negotiation and line probing

When one modem calls another, the answering modem sends back a tone to tell the caller that it is there. The two modems now start to negotiate with each other to decide what speed they will use, what kind of modulation to use, what carrier frequency and amplitude to use, and so on. If the connection is very bad, the modems will agree on a *fallback speed*, a slower speed which allows error-free communications even with a bad circuit. In fact, 28.8k bps and faster modems can even fall back to different speeds in each direction.

Echo suppression

Remember that the old FSK modems used different frequencies in each direction; this meant that only half the bandwidth was usable in each direction. To achieve high speeds, modern modems need the full 300-3500 Hz bandwidth of the line each way. Each modem therefore has to make sure that the outgoing and incoming signals are kept completely apart—none of the locally-generated signal should enter the local demodulator and cause errors.

The modulator therefore sends out a short test pulse, and the demodulator listens for it. Ideally, none of the test pulse should get through the duplexer, and none should be echoed back from the phone line, so the demodulator should hear nothing. In reality, though, the demodulator will hear a small signal, probably with some delay caused by travel through the phone system. The modem then computes an "equal, but opposite" signal which, when added to the signal heard by the demodulator, will cancel it out. In all further communication, the modem will automatically use this to compute an echo cancellation signal, sent to the demodulator to cancel out any echo or signal slipping the wrong way through the duplexer.

Scrambling

Even though the digital data being sent by the two modems may be asynchronous, the connection between the two modems is actually synchronous. This improves the speed somewhat, because synchronous connections do not require constant start and stop bits; they also have better error detection in the form of a CRC character.

But synchronous communications requires that the sending and receiving modems remain synchronized with each other. That is, each modem must have a clock oscillator, and the two clocks must run at exactly the same frequency. Rather than send a clock signal through the phone line (which would take up bandwidth and slow down the data), the receiving modem has to synchronize its clock from the data itself.

But some combinations of data may prevent that. For instance, look at the DPSK-4 scheme in **Fig. 7**. If the data consisted of a long string of ones, the signal would consist of a long carrier with a constant 0° phase shift. The receiving modem would have a difficult time telling where one symbol ends and another begins.

To avoid this problem, modern modems scramble the incoming data in a known way so as to avoid these troublesome combinations. (Needless to say, the receiving modem must then also unscramble the bits.)

Trellis coding

Even after all the previous tricks, the receiving modem is still likely to make errors when the constellation contains many points. Hence some sort of error correction is needed. Since errors are fairly likely, a backward error correction (where the receiver asks for a retransmission when it detects an error) is not desirable as a primary method—too much time would be wasted. So a form of forward error correction called trellis coding is used. To keep things as simple as possible (a difficult task!) let's confine ourselves to a 9600-bps modem.

Fig. 8 showed the 16-dot constellation of a simple 9600-bps modem. Actually, most modern 9600-bps modems use trellis coding with the 32-dot constellation of **Fig. 9**. When you look at this, you note that the dots are even closer together than those of **Fig. 8**; hence you probably suspect that there must be even more errors than before. This would be true—except that there are two more tricks up the designers' sleeves that we haven't yet covered: trellis modulation at the sending modem, and Viterbi detection at the receiving modem. These two techniques work together to greatly reduce errors.

First, we note that the telephone line can carry 2400 baud (symbols per second), and this is a 9600-bps modem. Hence we only need to put four bits on any one symbol, and therefore only need 2^4 or 16 different symbols; having 32 is overkill.

What the sending modem does, however, is to add a fifth error-correction bit to every group of four bits (in a sort of scrambling operation that mixes in some of the previous data, and actually changes two of the four desired bits as well); hence each symbol actually encodes five bits, although only four of these are actual data; this explains the 2^5 dots. The resulting five bits now depend not just on the current bits, but also on the data that was sent earlier.

So let's assume that you are sitting inside the sending modem, monitoring what is going on. You know that at some particular instant, the modem just output the particular symbol that corresponds to dot A in **Fig. 9**. The modem now gets the next group of four bits, and its trellis coding circuit computes a new five-bit code from it. But the coding circuit must follow very specific rules; given a particular set of four bits (and a particular history of past data) it must generate a very specific five-bit output code. In other words, since there are only 16 possible combinations of new data, there can only be 16 possible numbers it generates. In still other words, although five bits can make up 32 different numbers, only 16 of those 32 can actually come out of the coder; the other 16 are illegal at this instant (they could be generated other times, however).

What this means is this: there are 32 possible symbols in **Fig. 9**, but if you have just output symbol A, 16 of those 32 symbols are illegal for the next symbol. For instance, symbols B and C might be legal, but D and E might not.

So what does all this mean? It means that, although the dots in **Fig. 9** are much closer than those of **Fig. 8**, if you cross out all those that are illegal at any particular instant, you find that the remaining ones are roughly the same distance apart as those in **Fig. 8**. In other words, the presence of 32 dots is no worse than the 16 dots of **Fig. 8**.

So far, it looks like **Fig. 9** is no worse than **Fig. 8**, but no better either. But that changes with the next trick:

Viterbi detection

Let's suppose that the sending modem sent out a batch of data and ended up on symbol A (all of which the receiving modem received correctly). It next sends out symbols B and E in that order, but the receiving modem makes an error and thinks the sending modem sent out D and E (see **Fig. 9**).

Since all the previous data was received correctly, the receiving modem knows which 16 out of the 32 symbols would have been legal after A. It doesn't know which one was actually sent, but it does know that it couldn't have been D, because D is not legal after A (at this particular time).

Think of the correct sequence A-B-E as being a road through a maze—the maze is the constellation diagram—

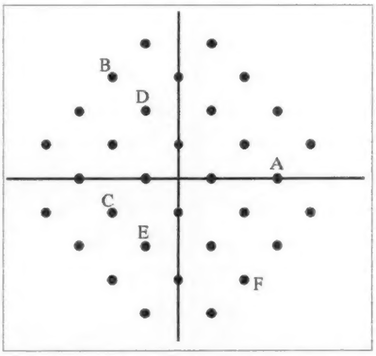


Fig. 9. Trellis constellation for a 9600-bps modem.

where only certain dots in the diagram have roads connecting them at any particular instant. The receiving modem now says to itself: I've been told that the sender route was A-D-E, but there is no road there. What is the closest actual road that starts at A, passes close to D, and ends close to E?

The receiving modem knows all the rules of the game; it can determine which roads go where and when. So it makes a list of all legal roads that start at A, pass close to D, and end close to E. That list might include roads A-B-E, as well as A-F-E and A-D-C. It then goes through a fairly simple computation to determine which of these is closest to the A-D-E route that it thinks the other modem sent, and comes up with A-B-E as being the most likely.

This process sounds pretty chancy (and it is—since it is based on the rules of probability), but actually works quite well. Think of probability this way: Suppose you take a quick measurement of, say, the length of a room. If you're fairly sloppy about it, your measurement may be wrong by several inches, but if you measure the room several times and average your readings, the average will generally be fairly close to the actual value because your various errors will tend to cancel themselves out.

The trellis code/Viterbi decoding scheme relies on the same principle. Modern modems generally keep track of up to four or five symbols in a row, and use the closest legal path that matches the last four or five received symbols. Since a path involving four or five consecutive symbols is fairly complex, the number of legal paths that will lie close is fairly small; hence the Viterbi decoder can pick out the correct path with a fairly good chance of success. Just in case of error, however, most modern modems apply error correction (and possibly data compression) to the received data before they pass it on to the communications program.

HamCall™ CD-ROM
U.S. & International - Over 1,406,000 listings

Over 106,000 new and updated International Listings, and all the latest U.S. listings, including vanity calls!

The HamCall CD-ROM allows you to look up over 1,406,000 callsigns from all over the world, including over 270 call areas.

The same CD works in DOS, Windows 3.x, Windows 95, and Macintosh. On a PC running Windows or DOS, you can look up hams by call, name, address, city, state, ZIP, call sign suffix, county, and now SOUNDEX last name searching. PC's can also view photographs, EDIT records, and calculate BEAM HEADING and DISTANCE. Macs can retreive by call, last name, and ZIP.

- Displays latitude/longitude for almost every U.S. and DX call based on city or town for greater precision.
- Calculates beam heading and distance from your home QTH automatically. Distance is measured in miles and kilometers.
- Prints standard 1-up labels for QSL cards, and can now print all information for each ham. Also supports copy and paste.

Also on HamCall are over 140,000 cross references from old to new calls, over 3,300 photographs, over 33,000 e-mail addresses, and much more.

Price is $50.00 plus $5.00 shipping U.S., $8.00 international.

BUCKMASTER
6196 Jefferson Highway
Mineral, VA 23117
e-mail: info@buck.com
540:894-5777 • 800:282-5628 • 540:894-9141 (fax)

CIRCLE 56 ON READER SERVICE CARD

28,800 bps modems ...

... use similar schemes, but with much greater complexity. For example, a 28,800 bps V.34 modem uses an actual line baud rate of 3200 symbols per second (just about the absolute maximum that the phone line can handle). To send 28,800 bps, it needs to pack 28,800/3200 or 9 bits into every symbol. This would give it a minimum of 2^9 or 512 dots on its constellation chart. If we drew this chart, the dots would be so close together that they would be almost impossible to tell apart. In reality, the V.34 modem uses trellis coding and Viterbi detection with 960 dots.

56k modems

Modem speeds of 28k or 33k bps seem to be about the fastest that the normal voice-oriented POTS telephone network can handle with today's technology. Faster speeds require a little help from the telephone company.

Fig. 1 showed how the POTS network handles a voice call with a microphone and earphone at each end, connected through hybrids to the local loop, and then using a pair of analog-to-digital and digital-to-analog converters at each end of the phone network itself. When a pair of 33,600 bps (or slower) modems talk to each other, the configuration is almost the same, except that a modulator replaces the microphone, and a demodulator replaces the earphone. As a result, digital data is first converted to audio; then an A-to-D converter converts it to digital for transmission through the network (which itself uses 64k data transmission); then a D-to-A converter converts it back into audio, and finally a demodulator converts it back to digital. A rather roundabout process, which results in less than optimum speed.

56k modems, such as US Robotics' (now 3Com) x2 modems, are slightly different. They are not really designed to work in pairs; in fact, if two 56k modems call each other, they will only work at 28,800 bps, just like any other V.34 modem. Instead, they are designed to allow an Internet customer to talk to his Internet service provider (ISP). The 56k modem forms an asymmetric system—fast one way ("downstream," from the ISP to you), slower the other ("upstream," from you to the ISP). This is ideal for accessing the Web.

In the upstream direction, the 56k modem works at normal 28,800 bps speed, using trellis/Viterbi coding, just as we described earlier. The difference is in the downstream direction.

In order to provide 56k service, the ISP must install a digital line from their computer back to the telephone company's central office. Rather than convert the digital downstream data into audio, the ISP sends it down as pure digital data. At the central office, the data bypasses the line card's A-to-D conversion; it stays digital all the way back to *your* central office, at which point it is converted to analog for the last portion of its trip, down to your modem.

The idea is that the initial A-to-D conversion at the ISP's central office creates the most problems; so the ISP bypasses that step by sending digital data directly into the network.

All the data arrives correctly at the central office serving your local loop; at this point, the bits are converted to discrete steps which (hopefully) will make it through your local loop, and be reconstructed by your modem. Unfortunately, there is a minor problem here.

In "Part 20," we said that telephone companies use µ-law compression to provide 13-bit accuracy with just 8-bit data. This varies the step size, to give small audio signals better resolution. Unfortunately, this converts some incoming digital data into voltages so small that they are corrupted by noise. To avoid this problem, the ISP sends 7-bit data, rather than 8-bit data. This results in 128 voltage steps rather than 256, eliminating the 128 smallest voltage levels—the ones that cause the most problem with noise. Alas, this reduces the data rate from 64k bps to 56k bps (actually, because of limits on maximum allowed signal levels, the actual speeds are closer to 53k bps).

Oscillator Circuits

Part two in a series of three.

Hugh Wells W6WTU
1411 18th St.
Manhattan Beach CA 90266

As you may recall, last time we discussed the feedback and crystal control of an oscillator. This month, we'll look at some typical self-excited and crystal-controlled oscillator circuits.

Remember, a crystal operating in the resonant mode will exhibit a low impedance across its terminals and a zero degree phase shift, while an anti-resonant crystal will exhibit a high impedance across its terminals and a 180° phase shift. In this article, circuits #3, #6, #7, #10, and #12 have a resonance requirement for the crystal. The crystals in #1, #2, #5, and #9 are anti-resonant.

The design of a circuit will take advantage of the specific impedance and phase characteristic provided by the crystal. In the case of the self-excited oscillator, the coil and capacitor in the resonant circuit are connected to meet the oscillator design requirements in a manner similar to the crystal.

Circuit 1: A Pierce design using an anti-resonant crystal in the feedback path between the collector and base of a transistor. Excitation, or crystal drive, is adjusted by the value of the 390 pF base bypass capacitor. This value is kept as small as possible, but large enough to achieve reliable oscillator starting. The frequency operating range for this circuit is about 100 kHz to 18 MHz.

Circuit 2: Another Pierce design uses an FET and operates as described in Circuit 1 above. The excitation capacitor is variable and is used to control the excitation level and to "pull" the frequency of the oscillator for netting purposes.

Circuit 3: This common-base Colpitts design requires the base impedance to be low for oscillation to be sustained. A resonant crystal exhibiting a low impedance from base to ground will enable oscillation to occur only at the frequency of the crystal's overtone. Frequency netting may be accomplished by varying the value of either the 3.9 pF or 47 pF capacitors. The 3.9 pF capacitor provides the feedback and the 47 pF controls the excitation level. The operating frequency range is crystal-overtone dependent (3rd, 5th, and 7th) covering 12 MHz to 200 MHz.

Circuit 4: In this self-excited common-emitter Colpitts oscillator, the coil and capacitor control the operating frequency. The ratio of the capacitor values connected between base, emitter and ground establish the feedback and oscillator stability. The frequency band is typically between 3 MHz and 30 MHz. Temperature stability of the circuit is fair and is dependent upon the mechanical stability of the resonant circuit components.

Circuit 5: This circuit is a crystal-controlled version of Circuit 4. It uses an anti-resonant crystal; the frequency stability is as good as the crystal. The 39 pF capacitor value may be varied for frequency netting and the excitation level is controlled by the value of the 68 pF capacitor. The operating frequency range for this circuit is about 100 kHz to 18 MHz.

Circuit 6: This is the common-base Colpitts oscillator; the feedback is obtained from the collector and coupled back to the emitter through the resonant crystal. Oscillation occurs when the impedance of the series crystal is slightly lower than the tuned circuit. The crystal drive is determined by the ratio of the 470 pF to the 130 pF capacitors. Note the 6.8 µH inductor across the crystal: Its purpose is to provide a DC path for the isolated top terminal of the crystal. The operating frequency range is crystal-overtone dependent (3rd, 5th, and 7th) covering 12 MHz to 200 MHz.

Circuit 7: A Hartley circuit is as popular as a Colpitts for implementing an oscillator. The basic difference between the designs is in the method for obtaining feedback—Hartley uses a tapped inductor while Colpitts uses a capacitor divider. Circuits 6 and 7 are nearly identical, including the frequency range, with the exception of the feedback method.

Circuit 8: This is a classic common-collector Hartley oscillator, used in broadcast radios since the late 1930s.

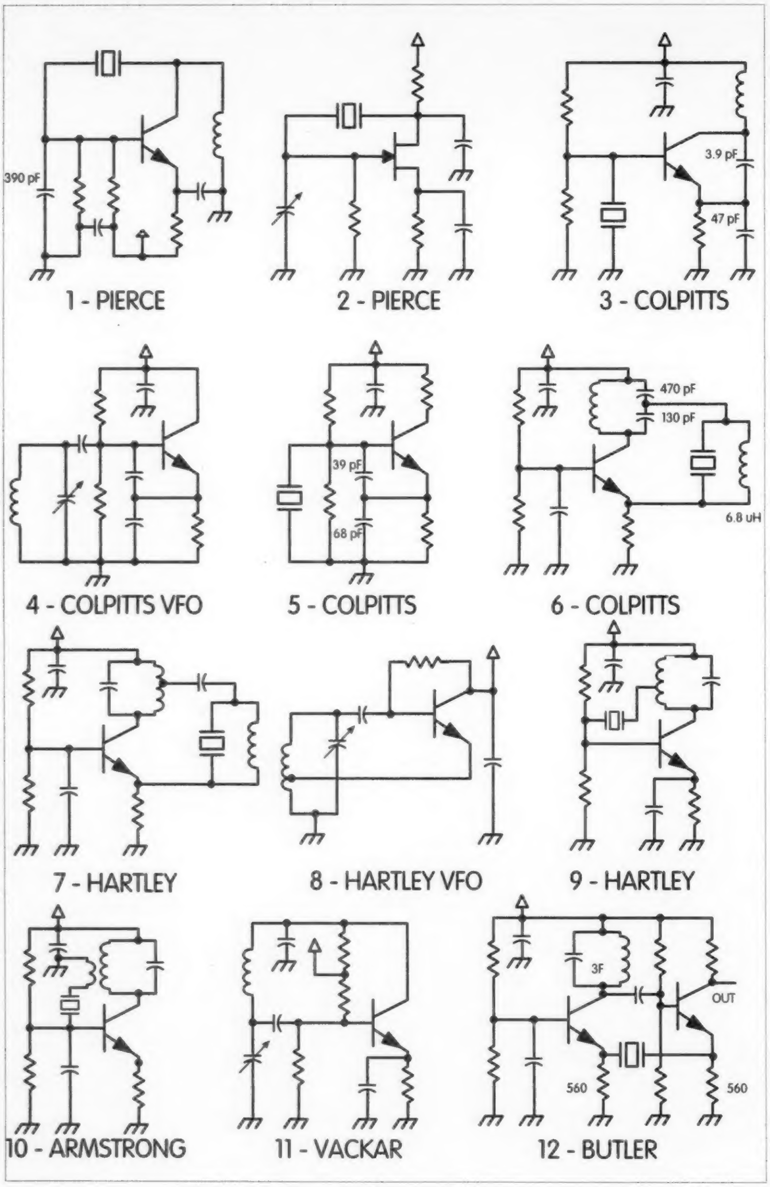


***Fig. 1.** Common—and not so common—transistorized oscillator circuits.*

The frequency stability is fair and totally dependent upon temperature and the mechanical stability of the components. It is a reliable oscillator with a wide operating frequency range from a few kilohertz to over 1 GHz.

Circuit 9: This unusual common-emitter Hartley oscillator requires the overtone crystal to operate essentially in the anti-resonant mode. However, overtone crystals are designed to operate in the shear mode which results in a resonant (series) function, yet this oscillator operates as designed by obtaining the required 180-degree phase shift across the inductance value between the collector and the crystal.

Circuit 10: Armstrong was a strong contributor to oscillator development, in addition to other radio accomplishments during the 1920s, '30s, and '40s. Characteristically, an Armstrong oscillator uses a tickler winding near the resonant circuit to obtain feedback for sustaining oscillation. In this circuit, the feedback will pass through the low impedance crystal when the operating frequency matches the resonant mode frequency of the crystal. The resonant circuit is tuned to match the overtone frequency of the crystal and can operate in the frequency range 12 MHz to 200 MHz.

Circuit 11: The Vackar oscillator is a rare design. It was developed after the advent of the transistor. This circuit takes advantage of a series-resonant circuit which has a low impedance to ground at each end and a high impedance in the middle. This high impedance point drives the base of the transistor. Note that the collector and emitter circuits are at a very low impedance to ground. Therefore, the transistor can only provide a current drive to the resonant circuit, which results in very good thermal isolation and frequency stability due to a non-dependency on transistor gain.

Circuit 12: The Butler oscillator was designed originally for use with vacuum tubes for the purpose of generating a high harmonic frequency output from a low- to medium-frequency crystal. Although the circuit shown will output the third harmonic of a resonant mode crystal (3rd, 5th, or 7th overtone), a tuned circuit originally existed in place of the 560 Ω resistor in the Butler design. The original output tuned circuit was tuned to the second harmonic of the "3F" circuit. The combination of the two tuned circuits provided a multiplier of six times the crystal frequency. The signal output amplitude was never quite as high as desired for a transmitter, but the circuit worked well when used for oscillator signal injection in a receiver, and was utilized as a stable, inexpensive local oscillator for VHF and UHF converters.

The circuits shown are only a few of the many oscillator designs developed over the years. However, those shown represent the basic design characteristics that have been the backbone of modern communications equipment. Recognizing an oscillator circuit by its designer's name enables an understanding of how the circuit functions and eases troubleshooting effort. Next time: the basics of frequency synthesizers.

ADVERTISERS' INDEX

R.S.#		page
•	A & A Engineering	79
351	Absolute Value Systems	38
68	Advanced Battery Systems	29
•	All Electronics Corp.	23
•	Alphalab	47
332	Antennas West	14
135	Antennas West	16
116	Antennas West	25
89	Antennas West	27
324	Antennas West	36
380	Antennas West	36
5	Antennas West	38
16	Astron Corporation	1
41	Barry Electronics Corp	43
42	Bilal Company	13
56	Buckmaster Publishing	70
168	Buckmaster Publishing	81
222	Byers Chassis Kits	36
184	C & S Sales, Inc.	63
99	Communication Concepts	29
10	Communications Specialists	63
276	Computer Aided Technology	40
166	Cubex	79
13	Doppler Systems	53
•	Down East Microwave	38
114	E. H. Yost	43
•	Electronics Book Club	17
193	GGTE	31
78	Hamsure	36
•	Hamtronics, Inc.	CV2
258	Hately Antenna Tech	43
42	Isotron	13
242	Jan Crystals	35
158	Japan Radio Co.	CV3
335	Menu Plus, Inc.	5
86	MFJ Enterprises	49
160	Micro Computer Concepts	16
136	Milestone Technologies	25
193	Morse Tutor Gold	31
248	Motron Electronics	19
64	Mouser Electronics	27
114	Mr. Nicd	43
•	PC Electronics	53
•	Peet Bros.	25
68	Periphex	29
•	Radio Book Shop	46
•	Radio Book Shop	50
•	Radio Book Shop	51
•	Radio Book Shop	58
•	Radio Book Shop	62
•	Radio Book Shop	88
•	Radio Amateur Callbook	11
34	Ramsey Electronics	2
254	Ross Distributing	38
241	Seagon Company	14
167	Sescom, Inc.	35
•	Sirio Antenna	CV4
250	Software Systems Consulting	35
69	Spectrum Electronics	27
141	The Nicad Lady	47
•	Thomas Miller	81
269	Tigertronics	19
22	Tri-Ex Tower Corporation	88
•	Universal Radio	13
259	Versatel Communications	81
191	W & W Associates	73
350	Warren Gregoire & Associates	31
245	Wavemach Communications	38

When you buy products from these advertisers, please tell them that you saw their ads in 73.

Subscribe to 73 right now...call 800-274-7373 (9-5 Monday-Friday EST).

BATTERIES

BUY DIRECT FROM US, THE MANUFACTURER

MasterCharger®

By simply changing adaptor cups, the MasterCharger will charge any Yaesu, Motorola, Icom, Kenwood, Alinco, etc. 2-Way Radio Battery

Special

FOR THE MONTH OF SEPTEMBER

10% OFF

on ALL

YAESU

Replacement Batteries

Look for October's Special of the Month

MONTHLY DISCOUNTS APPLICABLE TO END-USERS ONLY

MasterCharger® 1a+1a

Electrically Identical to MasterCharger I

If you have two different radios you'll only need one charger to accomodate both radios. Now by simply switching the switch to the left or right, you can determine which charging cup to activate.

NYS residents add 8.5% sales tax. Add $4.00 for postage and shipping.

Prices and specifications subject to change without notice

W & W Associates

800 South Broadway, Hicksville, NY 11801

WORLD WIDE DISTRIBUTORSHIP AVAILABLE. PLEASE INQUIRE:

E-Mail: w-wassoc@ix.netcom.com Web Site: http://www.wwassociates.com

In U.S. & Canada Call Toll Free (800) 221-0732 • In NYS (516) 942-0011 • FAX (516) 942-1944

MADE IN THE U.S.A.

SEND FOR FREE CATALOG AND PRICE LIST

The ABCs of HF Antennas

Beginning hams, take heart!

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108

Antennas can be a very confusing and often frustrating subject to understand, particularly for the newly licensed radio amateur. Entire books—quite a few of them, in fact—have been written on the subject of antennas over the years. Much of what we call *antenna theory* is often very difficult to visualize, partly because of the way it has been traditionally presented, and partly because it's often somewhat foreign to our normal view of the ways things work. This sometimes makes it hard for those in our hobby who aren't engineers to acquire a clear view of what is an admittedly complex subject. What I'm hoping to do here is to summarize some of the more *practical* information that you'll *most* need to know to make decisions on which antenna configuration might work best for you, without your having to sift through all of the available volumes right away.

I'll try to keep the discussion centered on antennas used in the HF bands—those below 30 MHz—with only brief references made to their VHF and UHF counterparts as needed for comparison, because the end use of antennas above 30 MHz can be very different from those used in the bands below 30 MHz. VHF/UHF antennas normally presume primarily line-of-sight communications and antennas of relatively small size. As a result, VHF/UHF antennas are pretty well standardized and normally don't present the same degree of installation problems that HF antennas present, since they can normally be easily installed on the smallest of urban lots. HF antennas, by contrast, are generally intended for use under ionospheric skip conditions and their installation should keep that objective in mind. They can also become very large physically as the frequency of operation goes lower, especially down at 1.8 MHz (160 meters). This often makes installation of an HF antenna in an urban environment "a challenge of compromises" on the part of the average amateur. It's therefore probably less confusing to keep these two ranges of ham antennas distinctly separate. These reasons will become even more apparent as we progress.

A single best?

To begin, perhaps it's best to be honest and say that there is no single best HF antenna for everyone; that's one reason why there are so many variations, I suppose. Just as there is no best automobile for everyone, there are many models and style categories to choose from. And like an automobile, the antenna that's *best* for you will depend in large part upon your own finances, the overall size that you can reasonably accommodate and the end result that you realistically hope to achieve—like the choice of an automobile or of many other products.

The Utopian antenna

We've all looked for that Utopian antenna, one that will cover all frequencies of interest, perhaps provide us with some gain and present a favorable angle of radiation, under all conditions. Unfortunately, like Utopia, it's not been discovered yet! In fact, books like the *ARRL Antenna Book* are as thick as they are because of the wide variety of possible antennas, and various refinements to them, that our fellow hams have experimented with over the years. It's also a book well worth your reading time after your exposure to the basics.

Instead of searching for something that doesn't yet exist, let's take a look at what does, and how it might apply to your individual circumstances. That's the key factor—your particular, individual circumstances. Each of us has practical limitations—some more so than others—on how much antenna wire, aluminum element tubing or tower structure we can put up, and still keep peace within our own family and in the neighborhood in general. This may be the most important factor in your final decision.

The two basic types

If you boil it down, there are two basic HF antenna types, but there are numerous variations on these two types, the classic half-wave horizontal wire dipole and the almost-as-classic ground-mounted, quarter-wave vertical, normally made of aluminum tubing. All others are ultimately based on these two design configurations. Also, try to keep this in mind: Any resonant antenna must be at least an electrical one-half-wavelength long, it can be longer, but not shorter. There are methods of making the physical length of an antenna shorter using coils, while maintaining the correct electrical length; these are often seen on both horizontal and vertical commercial amateur antenna designs. The minimum electrical one-half-wavelength requirement, however, must still be met. How is a quarter-wave vertical possible, then?

The horizontal dipole

The half-wave horizontal dipole, most often made simply of wire, is well-suited for the HF amateur bands below 30 MHz, producing a pattern that resembles the symbol for infinity when viewed from either of its ends (**Fig. 1**). It's the classical center-fed wire dipole antenna strung between two opposite supports, with 1/4-wavelength of wire on each side of a center insulator (**Fig. 2**). This type of antenna can be fed with coaxial cable at that center insulator—most often using a 1:1 balun—with a balanced feedpoint impedance of roughly 75 ohms. It can also be fed with open-wire transmission line—via a balanced output antenna matching unit—for operation over a number of non-resonant frequencies. Though not as efficient as when it's operating as a truly resonant antenna, this scheme works because the losses in the higher-impedance, open-wire transmission line are very low at these frequencies, whereas the losses in a low impedance coaxial cable would be excessive and perhaps even damaging to the radio or to the coaxial cable itself.

Horizontal half-wave wire antennas have been used ever since the very beginning of practical radio communications, and continue to be widely utilized by hams and some commercial shortwave installations to this day. Anything that's been proven by the test of time is worthy of your consideration. The biggest problem for most people seems to be in the ability to put one up high enough for the lowest of the HF frequencies. I'll get more into that a bit later. The other problem is in how to center-feed an antenna of this type and to have the transmission line drop down fairly close to where your equipment is located. That may be one reason why the backyard "radio shack" became popular in the early days of wireless communications, and still is in many parts of the world. The shack ended up where the transmission line drooped down from the dipole's center—that and the fact that the very early radio gear was definitely not "XYL-friendly" and was often best left out in the yard!

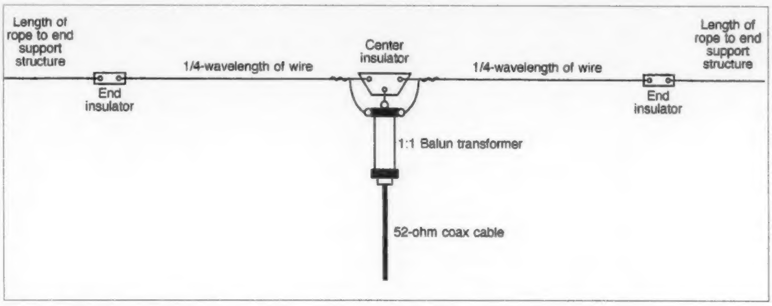


Fig. 2. Half-wave horizontal dipole, viewed from the side. Each wire element is 1/4-wavelength long, separated at the center by an insulator and connected to the coax cable via a 1:1 balun.

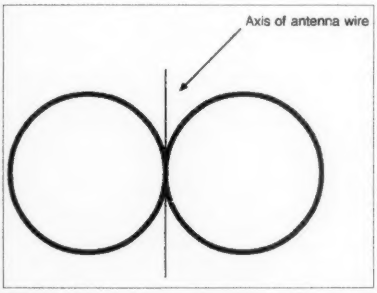


Fig. 1. Idealized radiation pattern of a half-wave horizontal dipole antenna, as viewed from directly above.

The quarter-wave vertical

The quarter-wave aluminum-tubing vertical antenna (**Fig. 3**) is the next most popular—and probably next oldest—form of transmitting and receiving antenna, and is also used by amateur radio operators and commercial broadcasters the world over. It will produce a basically circular radiation pattern when birds-eye-viewed from the very tip, looking downward (**Fig. 4**). It's typically fed at its base—very near the ground—with the shield of the coaxial cable going to the ground system directly, while the center conductor is connected to the above-ground vertical element. This represents a feedpoint impedance of about 35 ohms unbalanced, so it's also compatible with low-impedance coaxial cable transmission line.

You've probably noticed that the two feedpoint impedances that I've mentioned so far—75 ohms for a horizontal dipole and 35 ohms for a ground-mounted vertical—are slightly different from the 52-ohm coaxial cable that most hams traditionally use. These differences are too small to be of any real significance at these frequencies, representing a mismatch of about 1.5 to 1, and thus won't present a problem from a practical standpoint. They're also simply approximations of what a real-life antenna's feedpoint impedance might actually be; it can vary quite a bit. Additionally, it's generally considered best

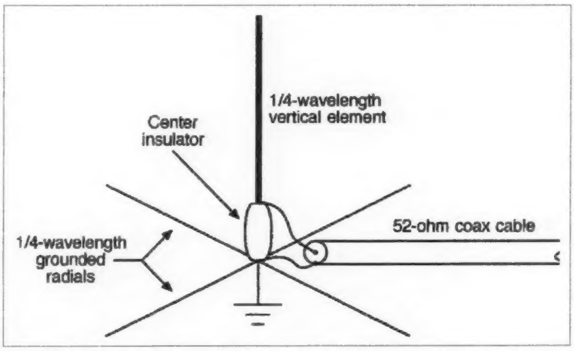

1/4-wavelength vertical element
Center insulator
52-ohm coax cable
1/4-wavelength grounded radials

Fig. 3. Quarter-wave vertical, viewed from the side. Each radial, and the main vertical element, is 1/4-wavelength long. The center conductor of the coax is connected directly to the vertical element and the shield of the coax to ground.

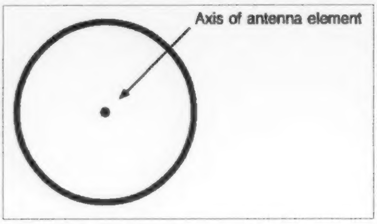


***Fig. 4.** Idealized radiation pattern of a 1/4-wave vertical, viewed from directly above.*

practice to use a balun—balanced to unbalanced—RF transformer when feeding any naturally balanced antenna, such as a horizontal dipole (**Fig. 5**). It aids in keeping RF currents off the outside of the coaxial cable's shield when feeding such a balanced antenna. If the outside shield of the coaxial cable is allowed to become part of the radiating system—as it may be without a balun—power can be wasted in ineffective transmission line radiation. Also, any existing TVI and RFI conditions might be aggravated and interference pick-up from household appliances during receive might be increased. It's easy to tell if an antenna is balanced or not; if one side of the antenna's transmission line connection point is not grounded, then it's usually considered a balanced antenna.

The ground radial system

Getting back to our HF vertical antenna installation, the active metal-tubing portion of a vertical antenna must be insulated from the ground mounting support and all quarter-wave verticals must have an effective ground plane beneath them. The ground plane is actually the other *half* of the antenna. Remember when I said that all antennas must be at least a half-wavelength long? Well, in the case of what we call a quarter-wave vertical, the other quarter-wave—the other *half* of the antenna—is in the ground plane beneath it. It's also sometimes called the phantom or *image* antenna. So a quarter-wave vertical isn't really a quarter-wavelength long; the other quarter-wave is the ground plane, and a good ground plane is absolutely essential. That ground plane can be the roof of an automobile, the hull of a metal ship, the fuselage of an airplane, a wire radial system or very conductive earth ground itself. Generally speaking, unless the antenna is over a salt marsh, the earth itself is an unpredictable and too often a variable ground plane. This variable other half of the antenna can represent substantial losses when left unaddressed.

Metallic radials—which can often simply be copper electrical house wires—are the most reliable, predictable and lowest-loss choice for a ground plane radial system in normal installations. If you intend to use a ground-mounted, quarter-wave vertical antenna for your station, don't forget to include the time, labor and expense of an adequate radial system into your initial considerations. Many have tried to circumvent that requirement, but few have been successful! Most of the tuning and other end performance problems associated with backyard, ground-mounted verticals can be traced to inadequate radial systems.

Taking a hint from the commercial AM broadcasters may be one of the best examples. A typical commercial AM broadcast station tower—which can be either a quarter-wave or a five-eighths-wave vertical—will have one quarter-wave-length radial, usually made of heavy copper strap, for every three compass degrees around the tower. That's 120 full-length quarter-wave radials emanating from the base of the tower in bicycle-wheel-spoke fashion. At the low-end of the AM broadcast band, each radial can be over 400 feet long, but it's the only way for the broadcaster to be sure of good stability in the tower's feedpoint impedance, along with the very least amount in ground losses—which represents energy lost in simply heating ground. Rarely will hams go to those extremes in installing a ground radial system, but it does illustrate the importance of a good radial system if you expect consistently predictable results, which commercial broadcasters must. Normally, ground soil conductivity is just too variable for professional installations. I'm often curious if hams are really aware of this when I hear folks talking about the "simplicity" of installing a quarter-wave, ground-mounted vertical. I have to believe that most really aren't. A well-installed vertical is not an easy job. Wide variations in feedpoint impedance and antenna effectiveness are almost inevitable without a well-laid-out radial system. Tossing up a vertical is easy; putting in a ground radial system for the HF bands is not!

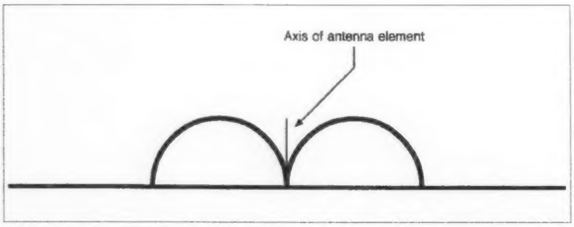


***Fig. 5.** Idealized radiation pattern of a 1/4-wave vertical, viewed from the side.*

Less-than-ideal installations

Of course, if you can't achieve the ideal, and very few can, you can still install a compromise radial system and make many rewarding contacts; just don't be too surprised when results change with soil conductivity during wet and dry weather, or between sizzling-hot summer and freezing winter conditions. Different soil compositions can also play a role in the results you'll experience. There's been a good deal written about this subject, so you can find much more in the literature if you have the desire to learn more before installing a ground-mounted, quarter-wave vertical antenna for the HF ham bands. In general, however, the more radials, the better. If you put in as many radials as your property and other considerations permit, you'll know that you've done all that you can and you'll just have to work around whatever variations might result. Few of us live in an open field, with only antenna considerations to be addressed, like commercial broadcasting stations do.

50 MHz and above

A brief diversion at this point: At VHF and UHF frequencies, an effective ground plane is easily achieved with four or more drooping radials, right at the above-ground vertical antenna support itself, or from the metallic structure of the car or other vehicle, in the case of a mobile installation. VHF/UHF antennas are also often greater than one-quarter-wavelength, or even one-half-wavelength today; five-eighths-wave and multiple five-eighths-wave vertical antennas are common, because of the potential gain that they offer by way of the more desirable vertically-compressed pattern possible with these longer antennas (**Fig. 6**). At VHF and UHF frequencies, the nearly impossible ideal situations that we face in the HF bands disappear completely because of the smaller sizes of antennas and their complementary radials at these frequencies. Instead, feedline loss considerations and height above average terrain become the dominant factors. The highest quality coaxial cable that you can afford and the greatest structurally-safe height that you can manage for a VHF/UHF installation are the keys to best performance at these frequencies.

Angle of radiation explored

Returning once again to the HF ham bands, we should address the subject of *angle of radiation*. This gets just a bit complex, and perhaps somewhat difficult to visualize, but it's important to have some acquaintance with the subject nonetheless. I'll be simplifying it as much as possible, so again, if you would like to delve deeper into it, there are references as to how to achieve to optimum angles of radiation in most of the antenna books.

The angle of radiation from an antenna within the amateur HF bands—those frequencies under 30 MHz—is important because it will be one determining factor in how far your signal can be expected to skip in the first, and subsequent, bounces off the ionosphere. Just like a ball bouncing off the cushion of a pool table, the angle at which your radio signal strikes the ionosphere will determine the equal, but opposite, angle that it's reflected back from the ionosphere—in general. This, in turn, normally determines how far the skip distance will be. I've said "in general" and "normally," because there are other factors involved, some of which we can't always predict, but this is the mechanism that we usually assume to be true.

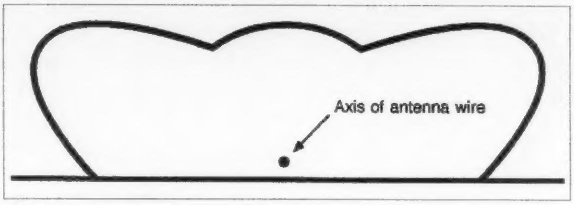


Fig. 7. Expected radiation pattern for a 1/2-wave horizontal wire-dipole antenna, mounted 1/2 wavelength above average ground soil composition, viewed from one end of the antenna wire's axis.

In general, the lower the angle at which your radio signal's main lobe strikes the ionosphere, the greater your expected skip distance will usually be.

Antenna patterns can be complex—they're usually not the simple, clean-looking patterns shown in basic textbooks. An antenna can have a main or major lobe, plus numerous minor lobes and side lobes. This is especially true of an HF horizontal antenna mounted fairly close to the ground or close to other nearby conducting objects (**Fig. 7**). "Fairly close" usually means within a half wavelength of another conducting object.

Keeping a horizontal antenna at least a half-wavelength away from other influencing factors can be a formidable task in the average home-installation when you consider that it's 66 feet at 40 meters, 33 feet at 20 meters and even 16 feet at 10 meters!

How high is up?

Antenna books also tell us that horizontal antennas should be at least a certain height above the ground to produce the optimum angle of radiation that we'd like to expect on a particular frequency band. By the way, that optimum angle of radiation varies with the band in question, but those heights work out to be at least 45 feet high for a 40-meter antenna, 40 feet up for the 20-meter band and 35 feet high at 10 meters. It's generally agreed that heights of 40 to 70 feet are good compromise elevations for reasonably predictable long-distance work on the bulk of the HF bands.

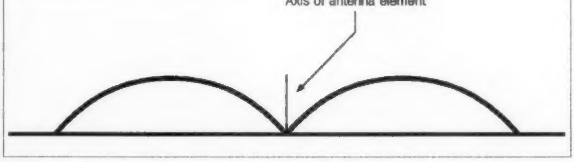


Fig. 6. Idealized vertically compressed radiation pattern of a 1/4-wave gain-designed antenna.

Perfection is elusive

What happens if you can't get a horizontal antenna up nearly that high? Before you give up, I'll add—as in the case of radials—that this is the ideal. Lots of antenna schemes will work, even at the lower frequency HF bands, and on normal city lots—just don't be surprised at less-than-optimum or less-than-totally-predictable results. Many hams have antennas located much closer to the ground and to other conductive surfaces (houses, garages, outbuildings, etc., which often have aluminum siding or other conductive surfaces or structures), than the books suggest, and they still put out respectable signals. The benchmark figures shown above are simply what we should aim for to achieve optimum results. But this is real life, and often our aims and our eventual realizations are very much different, aren't they? Antennas much closer to the ground and to other surrounding objects will still work, but not perhaps quite as the textbook says that they should. One of the challenges of ham radio is making do with less than perfect layouts, both inside and outside the ham shack. It's usually pretty easy to design the ideal system if you have an unlimited budget and unlimited room to do it in; it's much more challenging—and often more rewarding—to accomplish similar feats using less orthodox setups. Hams have been known for this right from the start and it's become something of a hallmark of the hobby.

Again, it's not that a low-to-the-ground HF horizontal antenna won't work; it's just not going work optimally—but that's okay as long as we understand why and if we don't set our expectations higher than our antennas!

Angle of radiation in vertical antennas

We've looked at how height above the Earth affects a horizontal HF antenna, but what about a ground-mounted vertical? You've probably heard that one of the attributes of a vertical at the HF frequencies is its low angle of radiation. That's because a vertical antenna's signal launch angle isn't as adversely affected by the ground beneath it nearly as much as in the case of a horizontal dipole installation. In fact, a vertical can be right at ground level and still provide a reasonably low signal launch angle. It's often cited as the reason why many hams choose that type of antenna when they have limited space, coupled perhaps with the inability to erect a tower or other tall structures needed for horizontal arrays. But as we noted before, the installation of a vertical isn't exactly free of problems, given the need for an effective ground-radial system. Even with that requirement, it may still be the best choice for an individual's particular circumstances; it's a matter that you'll have to decide for yourself based upon your own property restrictions and other physical considerations.

By understanding both the advantages and limitations of each choice, you should be armed with enough information that few surprises will await you once you've made a decision. The best surprise is no surprise!

Near-field effects

The presence of other nearby conducting obstacles is another matter altogether. A vertical's pattern—and perhaps tuning—can often be affected by other buildings and structures in the electrical near-field of the antenna, and most affected when they're within a half-wavelength of the antenna. Again, it may be impossible to avoid those near-field structures entirely, especially down on 40, 80 and 160 meters; again, we do the best that we can under the circumstances and work around any less-than-perfect results. It's also been said that any antenna, as long as it's able to be matched reasonably well to the transmitter and is well enough away from children and pets so that it's safe to operate, is much better than no antenna at all! It's very true. The operator must, however, be realistic with regard to how well any compromise antenna set-up will work, and exhibit some degree of patience when competing with others on the band whose antenna capabilities may be superior to his or her own. That, too, comes with knowledge of the theory and practical experience with a given installation.

Gain antennas

Changing gears a bit, I've not mentioned gain antennas to any degree so far. A horizontal beam antenna does provide gain, and can basically be thought of as a horizontal dipole with other near-field resonant elements placed to strategically alter the dipole's pattern in a desirable way; normally a beam concentrates most of the energy in one given direction, while restricting its radiation and pickup in all other directions. That's the theory, anyway! Beams aren't perfect, but they can do a very respectable job in accomplishing that objective. The major lobe of a well-designed, properly installed beam, is definitely concentrated in one direction only. There are minor side lobes, and some radiation from the rear of the beam, but most of the signal is radiated from the front as it's supposed to be. The very same conditions hold true for receiving, so beams can be used to reject interfering signals from other directions while providing varying degrees of gain for those in the favored direction—kind of a two-for-one bonus! The more elements a beam has, the greater its potential gain, but the narrower its beamwidth also becomes. Think of it in terms of a telephoto lens on a camera; it brings in objects from farther away, but also must be aimed more accurately.

What about gain in vertical antennas? As mentioned previously, gain in a VHF or UHF vertical is easily accomplished today with designs taller than one-half-wavelength, but in HF antennas, it becomes a matter of excessive overall height and the antenna would soon become too tall for most people to handle. It can be done, but it gets unwieldy. Gain and front-to-back rejection can be accomplished by installing two or more additional fixed vertical elements in beam-like fashion, but then you have to choose which direction to favor, because it isn't rotatable. Rotatable VHF/UHF vertical beams are quite practical though, and often used on those bands. In HF terms, however, adding ground-mounted vertical elements to achieve beam conditions becomes tricky; the additional vertical elements must be fed via phase-shifting networks that would not lend themselves to multiband operation very easily. I've mentioned it only because it is possible, and some AM broadcast stations employ this idea every day. Since broadcast stations are assigned just one particular frequency, they're often required to protect another station, some distance away but on the same frequency, by using several towers, fed out of phase, to provide a beam-like pattern along with minimal radiation in a certain direction—the direction of the other station being protected. But it's a juggling act, and not especially practical in ham radio terms. From a purely practical standpoint, think of HF vertical antennas as not having any gain—and probably a certain amount of loss—when compared to a full size horizontal dipole because most ground-mounted verticals are shortened trap-type designs to keep their size (height) down. Shortening an antenna reduces its radiation resistance—which is undesirable—and all traps introduce some loss. But then, the favorable angle of radiation from a vertical may at certain times more than make up for its lack of gain.

Radiation resistance, by the way, isn't a negative factor as the term resistance might suggest. All antennas need a certain amount of radiation resistance to function—it's part of how we explain what happens to the RF energy that's radiated into the air.

Additionally, there's the question of using horizontal-to-horizontal or vertical-to-vertical antennas. On the HF bands, it's many times a moot point. For line-of-sight communications it's important to maintain the same polarization, but once a signal begins to be reflected by the ionosphere, the polarization question is usually meaningless because polarity is shifted with each bounce encounter. And it doesn't always seem to be an exact 180-degree shift. In fact, most of the fading on HF skywave propagation can be attributed to polarization changes rather than actual signal strength variations. One only needs both a horizontal and a vertical antenna to switch between to prove that to themselves.

The half-wave vertical

Finally, in the category of HF vertical antennas, there also exists a shortened, trap-type of half-wave vertical. They're commercially available and offer the advantage of being ground-independent, i.e., not requiring an extensive ground plane, because they are already half-wave designs. A half-wave vertical can be fed at its center with 52-ohm coaxial cable directly or via a balun, just like a horizontal half-wave dipole. Some designs permit end-feeding with regular coaxial cable via a special low impedance to high impedance matching network right at the antenna itself. Any antenna displays a high-voltage, low-current condition at the very end of the radiating element. This translates into a high impedance at the antenna's end. Since our transmitters and coaxial cables are low impedance, they can't be tied directly to the end of an antenna without special considerations. That's where the special matching network mentioned comes in. It allows us to end-feed an antenna without ill effects on either the coaxial cable or our transmitter. In addition to not requiring an extensive radial system, a half-wave HF vertical can also be mounted up higher in the air if you choose, getting the high-current, low-voltage center of the antenna—which does most of the radiating—up above some of the surrounding obstructions. This can have a positive influence on the overall effectiveness of the antenna and can often be a worthwhile factor to consider if your installation plans permit it. By far, however, the biggest advantage to a half-wave design is its freedom from the need of an extensive radial system, usually making its installation much less involved. Just be sure to keep any close-to-the-ground mounted half-wave antenna protected from coming in contact with children or animals. Non-conducting fencing works well. Remember that the end of a half-wave antenna can be a RF high voltage point. Safety is rarely overdone.

Loop antennas

There are many antenna designs that have been tried and written up over the years, by hams the world over. Most are just variations on those already mentioned and go under the names of slopers, inverted vees, bent dipoles, etc. One relatively new design is worth mentioning, since it's now available commercially as well—the compact HF loop antenna. Loops have been around in various forms for some time, but the low-resistance, remotely-tunable, wide-band coverage loop is relatively new. It uses a very low-loss metal loop, about three feet in diameter, and is integrally coupled to a remotely controlled tuning unit. The package is small for the frequencies that it's able to cover, but keep in mind that loops have always been very high-Q devices, meaning that they must be retuned whenever you change frequencies even a small amount. That's not a tremendous problem when the loop is remotely tunable, but it does present another condition that you *must* meet when skipping around the band. Present-day commercial loops also have definite maximum power restrictions—usually in the area of 150 watts—so the use of an amplifier with a loop is out of the question right now. Most currently available loops will not operate below 10 MHz either, so the 40, 80 and 160-meter bands are out of reach with these antennas. Loops can be mounted horizontally, giving omni-directional (all direction) patterns, or they can be vertically mounted and rotated for a bi-directional (two direction) pattern. They are said to provide comparable performance to a basic dipole design. As with all new designs, it's best to talk to someone who has one and learn of their experiences before making a final decision.

As long as the restrictions mentioned here are kept in mind, loops certainly seem capable of providing HF antenna possibilities in restricted-space locations where operation below 30 MHz might not otherwise be possible.

Some final thoughts

This pretty much covers the various types of HF antennas normally available to us as amateur radio operators. As you can see, there are several basic design alternatives to choose from, and a seemingly endless number of variations on these basics. Experimentation with different antenna types is possible without tremendous financial investment. At the same time, an effective antenna will probably do more for your signal per dollar than any other modification that you can make to your station.

A more effective antenna will enhance both your transmitted signal and all received signals with the same effort, and that's hard to beat from any point of view. As mentioned at the beginning of the article, this has been a general discussion, with the new ham in mind, and by no means is it a complete treatment of an extensive subject. I've simply tried to put some of the basic information in logical order so that it can be more easily digested by the newcomer to ham radio. It seems that over the years that I've been involved in the hobby, more articles have been written about specific antennas than any other single topic! I'd encourage you to do much more reading on the subject in the various books and magazines available, and be assured that I'll continue to do the same. I also think you'll find that antennas are an extremely interesting topic for discussion—over the air or in person—among most hams, each one having their own favorite variation on the basics. Few other subjects will generate as much conversation as antennas will among most hams; it's interesting to see how staunchly certain design variations will be defended by their devotees. As you experience more and more of the hobby, your knowledge base will expand along with it, and it's my hope that this piece will have helped to put some basic perspective into that process. 73

See sidebar next page

CUBEX QUAD ANTENNA CO.
40 YEARS OF QUALITY ANTENNAS
SKYMASTER H.F. KITS FROM $275.95
PRE-TUNED H.F. QUADS FROM $389.95
Quad Antennas From 2 Through 40 Meters
2 METER 4 EL. PRE-TUNED $49.95 + S&H
6 METER 2 EL. PRE-TUNED $69.95 + S&H
BEST PRICES ON DOUBLE BRAIDED "DACRON" ANTENNA ROPE
visit our new web site http://www.cubex.com
Write Or Call For Free Catalog
2761 SATURN ST. "C" BREA CA 92621
(714) 577-9009 FAX (714) 577-9124

CIRCLE 166 ON READER SERVICE CARD

Smart Battery Charger

Smart Battery Charger
A&A Engineering

JUN 87 QST
BY WARREN DION N1BBH
FOR GEL-CELLS or LEAD ACID BATTERIES.
Features: Precision temperature tracking voltage reference & three mode charging sequence. Standard kit is for 12V @ 1/2 or 1 Amp, user selectable. Can be connected to the battery indefinately, will not overcharge. Weighs 2 pounds and measures 4"W x 5½"D x 2½"H. Finished enclosure included in kit.
Complete Kit Only $59.95
Assembled & Tested $79.95
CA Residents add 7.75% sales tax. S&H: $5.00 (insured). Foreign orders add 20%. For more info or price list; send legal size SASE (55¢) to:
A&A Engineering
2521 W. La Palma #K · Anaheim, CA 92801
(714) 952-2114 · FAX: (714) 952-3280

Some Practical Considerations for Your First Antenna

Here a few considerations to keep in mind when installing your first ham antenna.

•Talk to as many experienced hams as possible, getting their opinions and experiences with as many of the various antennas as you can, via clubs, hamfests, magazines and on-the-air contacts. Someone else's trials and failures can save you untold amounts of time, money and wasted effort in antenna decisions. Also, try to find someone who has actually used any commercially-made antenna that you might have your eye on, before purchasing it. Generally, once you've bought it, it's yours; you can't test drive something like an antenna before final purchase.

•Use only wire designed for antenna construction for a horizontal wire dipole, it will last longer and stretch less than general-purpose wire.

•Try to use only metal fittings that are intended for outdoor applications and will provide a safe strength-margin factor. If you're forced to use steel or other fittings that are subject to rust and corrosion, seal them with a protective finish and touch up that finish on a regular basis. It's safer and makes disassembly for maintenance, modification, or removal so much easier.

•Use high-quality insulators between the ends of the antenna wire and any supporting rope extensions; remember that the end of an antenna is a high-voltage, high-impedance point; also, use rope that's meant for antenna installation for the longest outdoor life expectations.

•Use high-quality coaxial cable, especially for all outdoor runs, preferably cable with non-contaminating outer jacketing material and good shielding-coverage qualities. Make sure that your coaxial cable is rated well over—two times—the power level that you expect to be running both now and in the future.

•Spend a bit of time practicing the correct method of coaxial cable connector installation before finalizing your new antenna system, preferably under the tutorship of an experienced fellow ham. It could save you a good deal of troubleshooting time later.

•Make all electrical connections as waterproof as possible. It's very important that coaxial cable be watertight throughout its entire length and that special attention be paid to waterproofing any connection points. Any water at all inside of the coaxial cable will reduce its effectiveness as an RF transmission line. Even soldered connections exposed to the elements will deteriorate faster than you might think. Waterproofing effort is rarely ever wasted effort.

•Keep any wires well-protected and out of the way of children, pets, and passers-by.

•Be sure that all building codes are followed, with regard to lightning protection, grounding and structural soundness of your antenna installation; your insurance may not cover costs associated with accidental losses if you don't. It will also allow you to sleep much more peacefully.

•Keep your local weather in mind when designing and installing any antenna system on your property. Some antenna designs and structures are simply not practical for all weather and wind conditions that can occur in every area of the country. Ice formed by freezing rain can add tremendous weight load to wire and beam antennas both.

•Don't put up more antenna structure than you can reasonably live with from both an esthetic and a maintenance point of view. Always get help when faced with a two—or more—man job.

•Include semi-yearly antenna inspections as part of your spring and fall outdoor chores. It's far better to locate a potential problem yourself than to be forced off the air by Mother Nature—I always remember that commercial about not being able to fool her!

•Lastly, and perhaps most important of all: Take your time, making every detail of the installation as professional as you can. It pays off, over and over again—but be prepared to make a few mistakes along the way; we all do!

NEVER SAY DIE

Continued from page 63

of most sprays, but on fruit you're going to eat without peeling such as strawberries, raspberries, grapes, and such, you'll be a whole lot safer if you rinse them in a silver colloid solution to kill off any unwanted passengers such as the *E. Coli* bacteria, which has recently made thousands sick and even killed a few people.

We'd be a lot healthier if our crops were being grown on land that has the minerals the plants need. The Hamacker-Weaver book in my guide gives the gory details, as does *Secrets of the Soil* by Chris Bird. You either add the missing minerals to your diet in pill form or your immune system will gradually peter out, and so will you. Weaver says he's eating a teaspoon of rock dust every day, which is a nitty-gritty solution to the problem.

Oh yes, you really ought to invest $1.50 in Dr. Supkow's 48-page book, *Rock Dust and the Environment*, Stardust Foundation, 400 Grove St., Glen Rock NJ 07452.

Shooting Kids

A recent PBS program showing how wild horses are tamed in minutes using a new technique also showed the same approach being used to help autistic children. They mentioned that about 15 out of every thousand kids is autistic. Hey, that's 1.5%! How do you like those odds for your kids?

An article in *The Townsend Letter for Doctors* carried a recent item about the link between autism and the DPT (diptheria-pertussis-tetanus) shots. The pertussis element of the DPT vaccine has long been suspected to cause autism.

It was a tetanus shot that damned near killed me when I was a kid. I was unconscious and delirious for almost a week and the doctor apologized for not testing me for an allergic reaction before giving me the shot. He said the next one of those would probably kill me. So I wasn't particularly surprised when the Navy medics did their best to give me another tetanus shot despite my protests.

All immunization shots present a chance for serious injury or death to your child, so my advice is *not* to sign any school waivers of responsibility for your children. Don't let 'em get inoculated. And if you have been brainwashed by the medical mafia into believing that immunization shots are beneficial, then either do your homework with the books, at least the Walene James book I've recommended, or say "baaa."

Reinventing Hamfests

Hamfests are slowly drying up and blowing away. And for some good reasons. So let's take a look at 'em and see if we can come up with some ideas to help bring hamfests back to life, and maybe even get them to help reinvigorate our moribund hobby.

There are seven groups of people involved in hamfests, each with different goals and needs which must be satisfied … or else! (1) The hamfest committee. (2) The commercial exhibitors. (3) The flea market exhibitors. (4) The ham attendees. (5) The speakers (entertainers). (6) The *prospective* ham attendees. (7) The suffering wives of monomaniacal hams. It's been proven endlessly in recent years that "if you build it they will come" is baloney. Hamfest committees have been building hamfests all over the place and the hams haven't been coming in greater and greater numbers.

As a potential exhibitor I have to see enough benefit to make it worth my while to spend the time and money it takes to exhibit. Sure, Dayton is BIG, but it is also almost terminally disorganized. Now that's a challenge for the hamfest committee. Yes, of course I have some ideas on how to reinvent this whole mess.

Hamfests need to cater to all seven of the groups, so let's look at them.

Commercial Exhibitors

There are two basic groups of commercial exhibitors. One is the manufacturers of ham equipment and accessories. The other is the dealers selling all this stuff. And, in recent years, also dealers selling computer hard and software. The manufacturers have a story to tell, so generally they have their new equipment set up and do their best to answer questions and explain what's new and different about it.

But during the few hours of the hamfest how many individual hams can an exhibitor reasonably expect to talk with in a meaningful way? A Saturday hamfest runs about eight hours. One person in the booth has to take at least three to five minutes per potential customer if he is going to do much in the way of explaining the new gear. That's around 12-15 per hour, unless he gets hung up with someone who has an endless supply of questions. Which happens all too often. Times eight is a maximum of around 120 a day, unless the poor guy takes off a few minutes for lunch.

Now divide that into the cost of the exhibit booth space, shipping the exhibit to the hamfest (and back), plus the cost to fly in the sales person, the hotel, rented car, and meals. That'll give you a good idea of why 90% of the potential exhibitors skip most hamfests. They are a terribly expensive and inefficient way to sell the product.

Is there any way to make hamfests so they can do a better sales job for manufacturers? Of course there is. When I organized the Hudson Division Convention booth sales I offered each manufacturer a 20-minute infomercial opportunity so he could show and tell to several hundred potential customers all at once instead of trying to deal with them one at a time. They loved it and the equipment sales at that hamfest set all-time records.

When I called manufacturers to sell them a booth and offered them the opportunity to do a show-and-tell, few turned me down. It was a powerful sales tool.

But the commercial exhibitors should also get some free help in setting up and tearing down their booths. They should get fed and watered through the day. They should have a quiet exhibitors' lounge to rest or talk business. If hamfests make it fun and profitable to exhibit, the commercial exhibitors will be there. And they tend to attract more attendees … and dealers.

Speakers

You'll attract better speakers if you can guarantee them a good audience. Most hamfests publish the speaking schedule in the hamfest program and think their work is done. There should be posters put up to remind the attendees of who is speaking, about what, and in which room, when. There should be clearly audible announcements. The sorry fact is that few hamfest attendees bother to stop and read the program during the hamfest, and even fewer after.

I used to run ads in hamfest program booklets, and it was rare that an ad ever resulted in any subscriptions—no matter what offer I put in the ad. It finally dawned on me that since there's rarely anything of interest to read in a hamfest program, hardly anybody ever bothers to read 'em. They take 'em home, throw them up on a shelf and that's the end of it.

Yes, I enjoy talking for two hours or more, and I don't come even close to running out of material. But I recommend that most talks be kept to 30-45 minutes. After all, the hamfest only lasts for a few hours, and the attendees want to see the exhibits, shop the flea market, attend a few talks and see how far down they can bargain the dealers on that new rig they want. Listening to four one-hour talks pretty well kills a whole day.

If you want top speaking talent you're going to have to pay the travel expenses for your key speakers. Travel, hotel, meals, and a rental car. That's what most conferences do. That's the treatment I get from the Tesla Society, the Global Sciences, and so on for my talks.

You'll probably bring the speakers in on Friday for a Saturday talk. Why not organize a ham dinner for that evening so any interested ham can have dinner with your guests? Charge 'em a little extra to cover the guests' meals. If you have anyone in the local area with a boat or plane, and there's time, maybe a little extra entertainment for your key speakers?

Why not make it a point to video and audio tape the talks? The videos can be shown at local club meetings for any members who missed the talks. And if the talk is a rouser you might be able to sell the audio tapes, with a royalty to the speaker. When I talk at Dayton I usually draw 300-400 in the audience. Then, when I sell a tape of my talk, I can sell a thousand or more copies. In St. Louis, where Bob Heil did a lot more to promote my talk, there were over a thousand in the audience.

BIOELECTRIFIER(TM)
EXPERIMENTAL MICRO-CURRENT SUPPLY
Now FULLY ASSEMBLED with batteries and
FINE SILVER (not stainless steel) electrodes
$89.50 +$2.50 S&H
Beware of IMMITATIONS!
ALSO...
COLLOIDAL SILVER GENERATORS
ZAPPERS, SILVER ELECTRODES, SEMI-KITS, etc.
send SASE for information
On the WEB: www.infocom.com/~thomil/
To order, send CHECK or MONEY ORDER to:
THOMAS MILLER, WA8YKN
314 South 9th Street
Richmond, IN 47374
Voice/FAX (765) 962-3509 thomil@infocom.com

REPEATER HEADQUARTERS
Make "Commercial Quality" repeaters from GE and Motorola Mobiles
- 45 Watt VHF Micor from $99
- 40 Watt UHF Master II from $199

Conversion Information Available!
http://www.versatelcom.com
VersaTel COMMUNICATIONS
Orders: 800 456 5548
Info: 307 266 1700
FAX: 307 266 3010
CIRCLE 259 ON READER SERVICE CARD

EVERY ISSUE OF
73 Amateur Radio Today
on Microfiche!

The entire run of 73 from October 1960 through last year is available.

You can have access to the treasures of 73 without several hundred pounds of bulky back issues. Our 24x fiche have 98 pages each and will fit in a card file on your desk.

We offer a battery operated hand held viewer for $75, and a desk model for $260. Libraries have these readers.

The collection of over 800 microfiche, is available as an entire set, (no partial sets) for $325, plus $5 shipping (USA). Annual updates available for $10. Satisfaction guaranteed or money back!

BUCKMASTER
6196 Jefferson Highway
Mineral, Virginia 23117
540:894-5777•800:282-5628
e-mail: info@buck.com
Fax 540:894-9141

CIRCLE 168 ON READER SERVICE CARD

Hamfest Committees

You want to pack the place. This means advertising in the ham magazines. It also means getting the word out locally so that every even partially-live ham within driving distance will be there, plus as many kids as you can get from the local schools who have shown an interest in hamming. Or computers, for that matter. Most hamfests these days are around two-thirds computer-oriented. Well, with every ham having one or two computers, plus a zillion young computer hobbyists, why not?

Get a list of every ham club within driving distance and send them flyers. Send their newsletter editor news releases every month for six months before the hamfest. Who's going to be exhibiting. Who'll be giving talks and about what. What have you for the packeteers? The satellite ops? The DXers? Contesters? And so on. Do you have anyone who can get around to clubs and talk up the hamfest? Are you going to have a CW copying contest, with certificates? A 2m antenna strength contest? A hidden transmitter hunt? What prizes have you rounded up?

Be sure to keep your local papers supplied with news. Ditto the news desks of the radio and TV stations. If there are any opportunities for interviews, get your best talker on there and get copies of the video to nearby clubs to show at meetings. Build the excitement.

Try to get your clubs to set up exhibits which will show newcomers to the hobby what packet is about, repeaters, ham satellites, ATV, slow scan, and so on. The more we can use hamfests as a way to help get youngsters interested in the hobby, the better chance we'll have of keeping our ham bands.

If you have a really good talker such as Jean Shepherd K2ORS, try to get him there a day early and schedule him on as many local talk and news shows on radio and TV as you can. I'm very good at this sort of thing too, in case you've asked me to be there. Maybe you've heard Art Bell W6OBB and me talking ham radio on his talk show, which reaches all 50 states.

Don't forget posters in any ham stores within driving distance. And flyers. Get flyers to any other nearby hamfests or other ham events.

Food

They're going to be there all day. Maybe two days. So have some good food for 'em. Find some vendors for popcorn, frozen yogurt, and the usual hot dogs and hamburgers. How about barbecue? Mmm, that smells good! Soft drinks, snack food. Beer is a bad idea.

Those Suffering Wives

Why make XYLs hate ham radio any more than they do already? Call a meeting of the hamfest committee's wives and see what you can put together to make the hamfest fun for the gals too. Looking at the 1000DX transceiver isn't going to send them into an orbit like it does the OM.

Bringing In The Techs

With the ham population heading toward 90% Techs … permanent Techs … maybe it's getting time to get a group of these guys together and see what they think will bring in your local 2m repeater-user denizens in droves. How about a panel discussion of VHF rigs? HTs? VHF antennas? The hamfest programs I've seen recently have had little to attract the Techs. But then the hamfest committees tend to be made up of old-timers, so Techs aren't given a lot of consideration.

Hamfests can be made to work again if they're kept relevant and diligently promoted. Old products have to be updated to stay in business, and so should hamfests.

Cleaning Up

A reader suggested a way for us to get the dirty-mouth hams to clean up their acts. Actually, as he pointed out, I proposed this approach some time ago, but as far as I know no one has bothered to follow up on it. Now, with the bands getting worse all the time, and with the understanding beginning to percolate through some very thick heads that neither the FCC nor the ARRL is going to do anything about this situation, perhaps this more direct approach to solving the problem will fly. Hey, we're

Continued on page 88

Number 82 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Surveying the surplus coax switch

This month, I want to get into the subject of coaxial switches and different types of RF switches in general. As you know, an RF switch is, electrically speaking, nothing more than a simple toggle switch activated by either a mechanical motion or a solenoid relay action. This motion, either electrical or mechanical, is used to transfer the contacts from receive to transmit in normal applications.

For low frequencies, the task can be performed by an open-air type of switch mounted in a suitable metal container equipped with coaxial connectors. Wiring at low frequencies is not critical. Going to the extreme in low frequency operations—say, in the 1 MHz area—the entire operation can be accomplished with long wire leads and a suitable manual switch. In the very early days of amateur operation, this was just the method used to switch an antenna from transmit to receive or between different antennas. It was inexpensive, available, and it worked well.

Today, most of the RF switching is taken care of with solenoid-operated switching devices. These devices started to show up in designs before World War II. I tore apart many different surplus military transceivers and high power transmitters to obtain parts to use in my early amateur construction projects. Not having won the lottery, nor having deep pockets, I had to be frugal in my radio ventures and thus used these surplus resources to the max.

I can remember dismantling ART-13s, ARC-5s, and other HF units, as well as VHF counterparts to the ARC-5 line and even some military surplus cavity units in the low frequency microwave area of 1000 MHz. This surplus material left me with a wealth of component parts, as well as experience in stocking a large junk box for

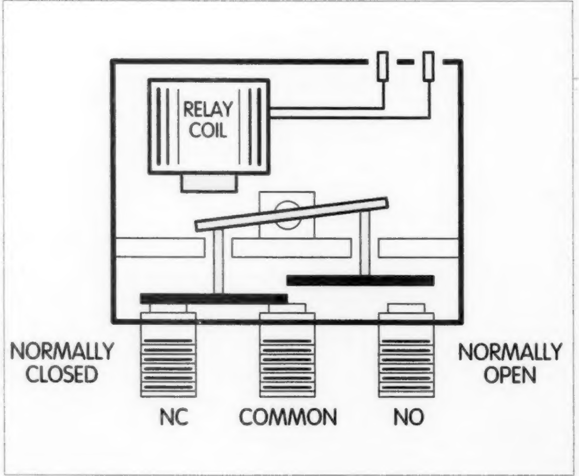


Fig. 1. *Microwave switch internal construction. Note balanced actuator arm that pushes bar contact from grounded out-of-circuit position to contact from one side of switch to center contact. Left or right side of switch operation identical. Typical frequency of operation from VHF to 24 GHz. Size of switch decreases to reflect increases in frequency.*

construction projects. Material scrounged included tubes, fixed and variable caps, resistors, and any RF switches I could find.

Well, since I was quite smitten by VHF operation in those early days and they were within my price range, I salvaged the best coaxial relays I could obtain from these surplus sources. The switches I used were not ideal but they *were* on hand. They were full coaxial, except for one terminal which was a solder-lead type. Surplus being what it was, that was how it was used in the VHF ARC-5 radios I pulled the switch from. The relay was external to the metallic enclosure, and operated the armature which pushed an insulated bar into the box to transfer the function of the enclosed relay contacts. It was not ideal, but for surplus prices in the early '60s it worked well until something better came along.

The real primo coax relay was a Dow Key. It was much sought after, if you could afford one. The only other alternative was a glass vacuum RF switch that was removed from the high power HF military surplus radios. I never used these in VHF operation, but know now that in suitable enclosures they work quite well. In those early days, we did the best we could.

Today we have so many choices with commercial equipment—and not much relief in price unless you scrounge the surplus markets and swap meets looking for material. If you want quality and want it now, you have to pay for it. If you can assemble a shopping list and be willing to do some trading or swap meet looking, it will come your way eventually. It just might take a little time to fall into place.

What are your choices and what relays are the best for you? Do you even need a coax relay, since most of the transceivers packaged today provide all switching needed in a basic transceiver for HF or VHF/UHF operations? What can you do to evaluate just what is right for your situation? Well, the answers are not simple, as a little background material is needed to get you up to speed on what is required for a frequency by frequency and power level type of approach.

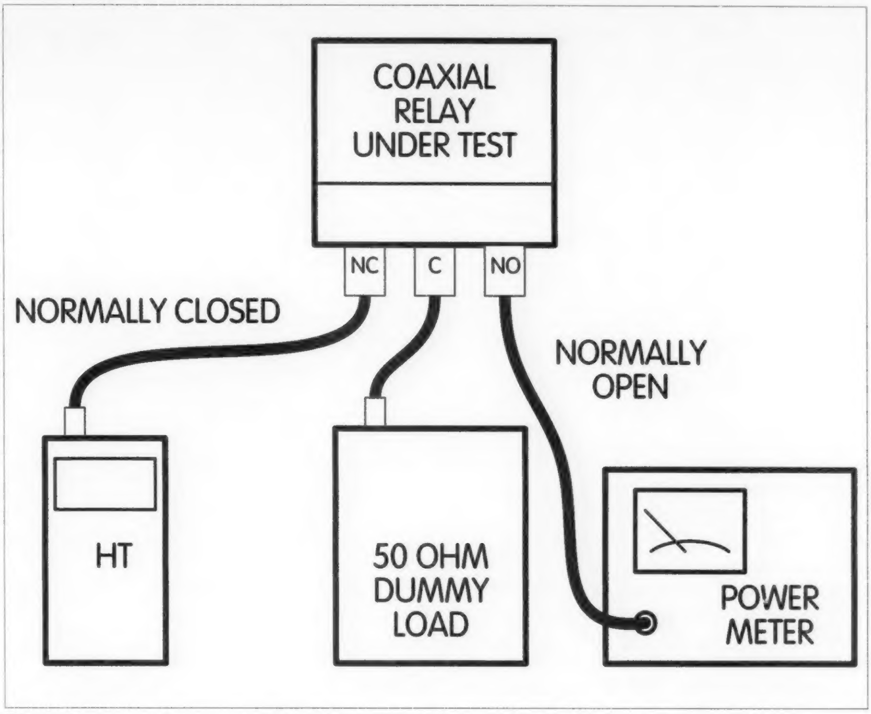


Fig. 2. *Test setup to measure isolation between switch ports. Signal generator (transmitter) places power through contacts of switch. Power measurement made at open switch contact to verify isolation of switch. Isolation should be better than 50 dB for a good switch.*

To start to evaluate coaxial switches in general, you first need to lay out just what you want to switch and list the frequency and power level involved (as everything changes as you get higher and higher in frequency). As frequency increases above 1,000 MHz, things get downright mean in what it takes to perform well. Also, power handling capabilities decrease as frequency is increased.

What is going on internal to the relays is much the same as with construction practices used at similar frequencies. At low frequencies such as 80 and 40 meters, open wiring with no particular attention to wire dress or position is required. (Look at antenna tuners, for example, to see what is allowed at a particular frequency.) As we get into 20 to 10 meters, it starts to get fussy with regard not only to lead dress but also the length of wire used to make connections. At 6 and 2 meters, connections used at lower frequencies will be called RF chokes and actually impede the flow of RF. On 6 and 2 meters, very short connections are a must.

As we get even higher in frequency, the components used in construction of a switch start to take on a very large fractional portion of a wavelength in physical size. When the dimension becomes large, the switch elements tend to radiate the energy they are trying to switch. In these devices, special precautions must be taken to eliminate cross coupling between unused switch positions and other parts of the switch. At low frequencies such as 1 MHz, these cross coupling questions are just as important, but due to the very long wavelengths involved, construction lead length is not critical.

What, then, constitutes good construction of an RF switch for modest power levels that will function at HF through 450 MHz? Let's examine what is offered for sale today and take a look at the internal structure of what makes a good manual switch.

What is a manual switch? Well, there are several being offered for sale today. Physically, the basic switch has one input and one connection path out and a switchable alternate path. SPDT—Single Pole, Double Throw—is the most common one.

Switches from military or commercial surplus include multiple outputs just like the Transco manual switch I described earlier. Most common types I see on the surplus market have 24-volt relay coils, SMA miniature connectors, and are intended for UHF through microwave frequencies. The miniature multi-output types are not rotary in operation but instead use an individual relay for each contact selected. The relays shown in **Fig. 1** are of the type I use at 10 GHz. The switch is about the size of a large postage stamp. Others similarly constructed (but much larger by a factor of about ten) use type-N connectors and work at lower frequencies and higher power levels.

For HF operation, a home-constructed switch might take the form of a heavy-duty ceramic rotary switch with contacts that are about 1/4-inch in diameter. Additionally, the ceramic switch spring is constructed out of several layers of spring material and backed up with a heavy brass or plated-steel armature for the switch contact rotary section. This type of switch is typical of a surplus heavy-duty RF switch removed from older military surplus. Usually it is so heavy it must be mounted on a panel in order to operate the manual switch from one position to the other. It switches into position with a loud "snap" sound, making very evident it switched.

I would hesitate to use this type of switch above 20 MHz and rate it iffy at best near that frequency. An improvement would be to mount the rotary switch in a metal box and fix connectors for each switch contact. As you look inside the metal box of such a switch and its wiring, you can see that there is a certain amount of coupling between each section of the switch. In other words, there is still some coupling (poor isolation) between sections of the switch that are in proximity to each other. Think of the operation as coupling between a tangle of clip leads scattered on your workbench.

To test this isolation, you just run a test signal through the closed contact path and test at the open contact to see how much of the signal leaks through to here and its connecting leads (see **Fig. 2**). What you want to see is lots of isolation and very little signal leaking through. The measure of the loss is the rating of isolation, usually expressed as dB isolation. In this simple switch loss is low, giving it a poor rating above 20 MHz because of poor isolation as frequency is increased above a point. Operation at lower frequencies is quite proper.

The reason you want high loss between the switch contacts is that a transmit path might have 100 watts of power going to the antenna. The open contact is the receiver, and if the isolation is poor, an appreciable amount of power will be coupled into the front end of the receiver. This is not what we want to happen. With a receiver sensitive to minus 100 dB and transmitters with output powers in the 100 watt category (+50 dB), it is safe to assume that a great switch would have isolation in the 50 dB or better range to protect the equipment (receiver) it is switching.

Coupling (poor isolation) is the bane of any coaxial relay circuit. If the frequency is low, the extraneous wiring can be tolerated because the wavelength at these lower frequencies is quite lengthy and short hookup wiring techniques are tolerated. As the frequency rises, shorter wiring methods must be used to limit excess wiring and its associated coupling. All is not lost, as there are switch layouts that help to minimize coupling between switch elements and make them virtually invisible to each other.

What layout can we use to provide low coupling or high loss between adjacent elements of the switch? Well, when we think it out, it can be shown that the best switch would duplicate as best it could a manual coaxial connection. The switch would look in this scenario like a manual coaxial switch panel. The switch panel is one that is entirely made up of coaxial connectors and one patch cord (coaxial). When you wanted to select a new port, you would have to unscrew the connector and move the cord to the new port connector. Not very practical, but very efficient in minimizing coupling and effecting very high isolation, which is excellent.

What is needed is a mechanical contrivance that duplicates this action to obtain the very best in isolation and at the same time maintain almost zero coupling between ports—just like the previous coaxial connector-and-cord scenario. I am not dreaming, as some of you might suspect by now, but rather I am just trying to make you aware of what is going on and how important isolation can be.

The switch that conforms to this design principle is made by Transco. Its operation is exactly what was previously described in a manual-patch cord scenario. The switch I tested has manual operation and six possible output ports. It exhibits all the quality of the coaxial connector-and-cord operation in a very compact rotary coaxial switch. It uses a spring contactor coaxial hairpin, allowing contact in a coaxial environment with only one contact between the selected main input/output connector. To switch it to another position by manual rotary action, it has a cam action to unseat connections before reseating into the new selected position.

There is virtually no coupling between the main and unselected switch ports, due to the excellent shielding between master and selected rotary contact all done in a coaxial environment. This minimum coupling is accomplished by this cam-operated coaxial hairpin internal to the switch. In all respects this hairpin is just like unscrewing a connector and transferring it to another connector.

As far as isolation goes, the other connectors might as well be in the junk box as you cannot see them with this type of mechanical contact switching. The other unused connectors are out of the picture, electrically speaking. The selected path and its connector are totally coaxial and shielded from everybody else.

The Transco switch is quite robust; I have used it to 450 MHz with no problem. This switch must be bolted to something sturdy, as it does require a few pounds of pull to rotate the switch. You need this hard mounting in order to turn the switch by hand. It has quite a stiff cam action and produces a sharp "snap" sound (of the kind mentioned earlier) when the coaxial hairpin is reseated.

The relay that I show in **Fig. 1** and use at 10 GHz is quite small and uses miniature SMA coaxial connectors. The coax cable that is used has Teflon™ insulation and relatively low loss at these frequencies. As you can see in **Fig. 1**, when the relay has current flowing through the coil it attracts the armature to the pole piece on the coil. This activates the armature in a teeter-totter type of function and uses insulated push rods that raise one end and lower the other end of the switch contacts.

The unused switch contact is pulled toward the top of the switch's enclosed chamber and grounds out on top of the switch compartment. The other element is pushed into contact with the previously open contact and the center main contact. The process reverses when relay current is removed. The internal compartment where this switching action takes place is much like a very short section of air dielectric coaxial cable with the exception that its internal dimensions are square and the impedance is 50 ohms. The impedance is determined by the ratio of inner to outer conductors.

Think of this inner-to-outer ratio as quite similar to the ratio between coaxial cable and its inner and outer conductor. The action is quite the same. When the switch duplicates as closely as it can the coaxial environment and the internal elements are a fraction of a wavelength at the frequency of interest, it will function well. 73

Number 84 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell P.E. K0OV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
Web: [http://members.aol.com/homingin/]

Low-cost monitor for the NorthScope

"Is that radar in your car?" I'm not surprised when visitors to the starting point of our hidden transmitter hunts (T-hunts) ask that question. The lingering yellow glow of the lines on my cathode-ray tube (CRT) display are reminiscent of radar scopes in pre-computer times. But these lines are signal bearings, not aircraft tracks.

Continued

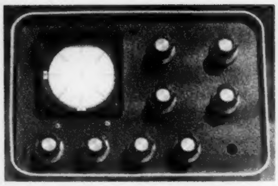


***Photo A.** The Heathkit Scanalyzer after repainting the front panel and replacing the grid screen under the CRT bezel with a transparent compass overlay. Next comes labeling. The hole at lower right will be filled by a future control.*

This month's "Homing In" is the final installment of a series on north-referenced bearing readouts for radio direction finding (RDF). July's column covered remote heading sensor technology. An inexpensive fluxgate compass module gives you a dashboard indication of your mobile antenna mast position with respect to true north. With it, you can quickly tell if the bearing to a hidden T is steady or shifting as you drive on winding roads in the dark.

"Homing In" for August described an analog multiplier circuit that combines fluxgate compass and receiver S-meter signals to produce a "north-up" display of signal strength versus direction. I call it the NorthScope. Its polar plot simplifies the task of separating the direct signal from multiple reflections (multipath) in urban and hilly areas.

Like a radar scope, a north-up display must have persistence of several seconds so that the operator can "stack up" traces. That makes it possible to tell the difference between fluttering reflections and more stable direct signals. Ordinary oscilloscopes and computer monitors are not suitable because their persistence is only a few milliseconds. Surplus waveform storage oscilloscopes and medical monitors make fine readouts, but they require 110-volt AC power and are somewhat expensive.

A recycled boat anchor

I was searching the swap meets for parts to build a home-brew display when I discovered a '60s-vintage Heathkit SB-620 Scanalyzer. There, in one case, were all the hard-to-find items I needed—including the long-persistence CRT, mounting hardware, mu-metal magnetic shield, socket, panel, bezel, high voltage supply, and beam controls. What's more, the cabinet had plenty of room for the interface circuit with its front-panel controls.

Constructing a CRT display from scratch is possible. I built a bigger one for my high school science fair years ago, but surplus scope parts were much easier to find then. Nowadays, the modified Scanalyzer approach is far simpler and cheaper. They show up regularly in estate sales and at the three computer/electronics swap meets in my area. A recent issue of *Amateur Radio Trader* magazine had an SB-620 listed at $75. This appears to be a typical "street price." Be sure to get the manual, too.

The Scanalyzer need not be in full working condition, but the high voltage supply, CRT and beam controls (INTENSITY, FOCUS and ASTIGMATISM) should be functional before you begin the modifications. There are Internet mailing lists and Web pages devoted to "boat anchor" equipment and Heathkits that can help you locate an SB-620 and repair it if necessary. You will find links to these resources at the "Homing In" Web site. My site also has information on CRT sources and high voltage supply schematics for those who choose to build a monitor from the ground up.

The SB-620 has a 3RP7 high-persistence CRT with a 2-5/8-inch-diameter face (**Photo A**). This is quite suitable for a mobile display. I had considered the next size larger CRTs for the project, but electrostatically focused five-inch tubes are about 17 inches long, necessitating a deep enclosure. They also require much higher acceleration and deflection voltages than the 3RP7.

WARNING: Use extreme caution when working on your monitor. Voltages high enough to cause serious injury or death are present in the power supply, beam and deflection circuits. There is no substitute for caution, prudence and clear thinking when working with high voltage. Mount all circuits inside a grounded metal enclosure so that high voltage points are never exposed to the user during normal operation.

Turn off all power and wait for capacitors to discharge fully before removing the cover. With power off, short all capacitor terminals in the high voltage supply to ground with the metal shaft of an insulated screwdriver before touching any circuits. Observe all safety precautions including keeping one hand in your pocket when making adjustments and measurements with the cover removed. Do not work on HV circuits when fatigued or under the influence of medication or intoxicants. Measure high voltages only with instruments and probes designed for this purpose.

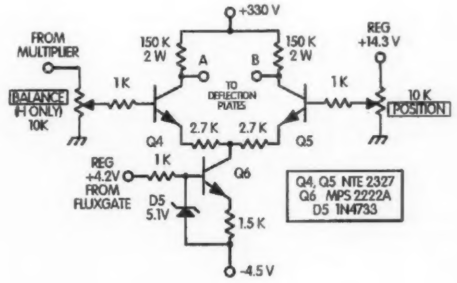


***Fig. 1.** Schematic of the new deflection circuits. Two are required, each with a spot positioning potentiometer on the front panel. A and B outputs of the horizontal (X) circuit go to the orange and yellow CRT socket wires, respectively. A and B outputs of the vertical (Y) circuit go to white and violet socket wires.*

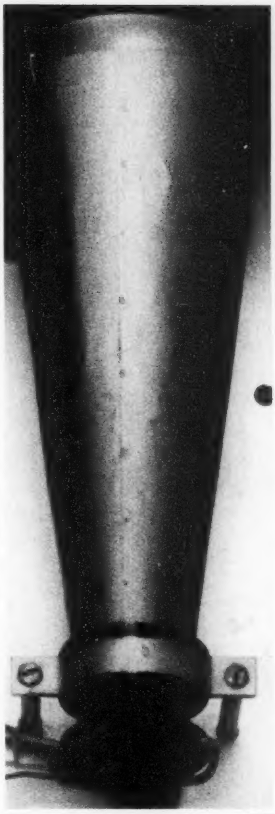


***Photo B.** Rear view of the CRT inside its mu-metal magnetic shield, with socket. Leave the shield on the CRT to prevent spurious deflection due to magnetic fields from the transformers.*

Use care when handling a CRT due to its high vacuum. Do not

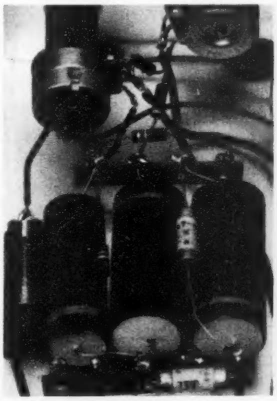


***Photo C.** Components in the CRT cathode supply are as originally described in the SB-620 manual. Note the long insulated bushing on the INTENSITY control. The piggyback switch is rewired for +12 volts.*

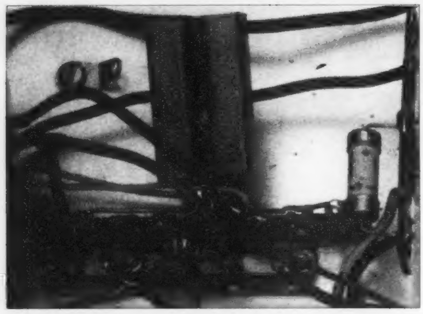


Photo D. *This series regulator stabilizes the acceleration electrode and deflection supply voltages to prevent spot movement as vehicle voltage fluctuates.*

strike, scratch or subject the CRT to more than moderate pressure at any time. A fracture of the glass could result in an implosion capable of causing injury.

Tubes out, ICs in

The first step in the SB-620 conversion is to remove all of the RF circuits, tubes, tube sockets and associated components, except for the CRT of course. The INTENSITY and FOCUS potentiometers are used as is. All other front panel controls are no longer needed. Replace and rewire them with switches and potentiometers for the new INPUT, BALANCE, HORIZONTAL POSITION, VERTICAL POSITION, SIZE and OFFSET controls.

Disconnect the violet, orange, white and yellow CRT socket wires at the chassis end, leaving the other socket wires connected to the supply (**Photo B**). Leave all power supply components and wiring intact for now. Note that the INTENSITY control has an extended insulated shaft and bushing. For high-voltage safety, be sure this is assembled per the construction manual and **Photo C**.

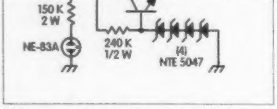


Fig. 2. *Schematic of the +330-volt regulator. The NE-83A indicator and 33k resistor are on the original SB-620 front panel.*

Build and install new X and Y deflection circuits per **Fig. 1**. A perfboard photo is in last month's "Homing In." The previously disconnected CRT socket deflection wires connect to these circuits. Except as noted, added resistors are quarter-watt. Higher wattage resistors must be used in some places for their greater voltage standoff capabilities.

There is only one BALANCE control, used in the horizontal deflection amplifier. It equalizes the X and Y path gains, compensating for the slightly higher horizontal deflection plate sensitivity in the CRT. When performing the alignment described last month, adjust the BALANCE control to obtain a perfect circle trace instead of a horizontal or vertical ellipse.

Only a few changes are required to the rest of the power supply and beam circuits. Rewire the on/off switch and main fuse to open the vehicle's DC input instead of the main transformer primary. The DC fuse should be two amperes fast-blow. Negative supply (-4.5 V) for the LM324 comes from the original DC heater source (D8-D11 and C54).

Deflection supply and CRT astigmatism (Anode #2) supply voltages are regulated for mobile operation. The +330-volt regulator circuit is in **Fig. 2** and **Photo D**. I built it on an added eight-terminal strip next to the five-terminal strip at position E on the chassis. Be sure to provide heat-sinking for the transistor, but do not ground the sink. Remove the wire from the top of the astigmatism control (lug #3, farthest from the power input grommet) to the positive end of C53-C in the power supply. Connect the regulator input to the positive end of C51. The regulator output goes to lug #3 of the astigmatism control and the common point of the four 150k collector resistors in the deflection circuits.

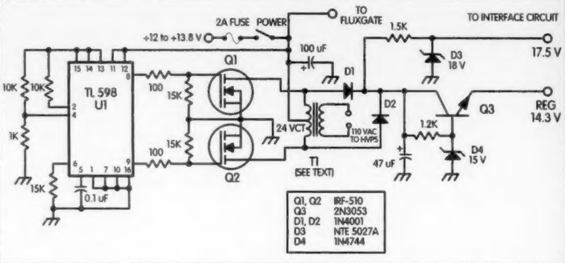


Fig. 3. *Schematic of the DC-to-AC converter. Outputs are 110 VAC square-wave for the high voltage supply and positive DC for the analog multiplier circuits.*

Powering the scope from a car battery is easy with the circuit of **Fig. 3** and **Photo E**. The TL598 converter IC is available from distributors of Texas Instruments™ semiconductors. It generates alternating pulses at 500 Hz to drive the two switching transistors. Although the TL598 has provisions for voltage and current feedback, I found it to be unnecessary in this application.

Mount the transistors to the chassis with supplied insulating hardware. The transformer (Triad F-45X) is connected "backwards." Its 24-volt center-tapped secondary connects to the transistor drain pins. Output at the primary is 110 volts square wave. If you can't find the Triad transformer, you can substitute Radio Shack™ 273-1512, but output voltages will be about 5% lower.

There is no problem feeding the square-wave chopper output into the main transformer primary to operate the scope instead of a sine wave. The RMS voltage at the CRT heater is very close to the wall power value with normal +13.8-volt input. The capacitor-input high voltage supply filters produce about 35% lower voltages, compared to AC power. This is an advantage because it lowers the CRT deflection voltage requirements such that solid-state drivers of **Fig. 1** are practical. Spot brightness is more than adequate at night, but add a sunshield for daytime hunts. You can set the INTENSITY control to maximum without burning the CRT phosphors.

Except for the special components mentioned above and the NTE semiconductors, all of the new parts should be available at your local Radio Shack. NTE transistors and diodes are sold by local parts distributors nationally. My junk box played a large role in parts selection for this project. Experienced experimenters should feel free to make appropriate substitutions.

With modifications completed and the analog multiplier circuits installed, your NorthScope should be ready to align and operate. Be sure to check your work thoroughly before the first "smoke test." Warm-up time of the CRT is about 20 seconds. DC supply current is 600 milliamperes in normal operation, not including the fluxgate compass. Follow the alignment procedures given last month for the fluxgate-to-CRT interface.

Better than a Doppler?

Fans of Doppler RDF units may argue that their method is

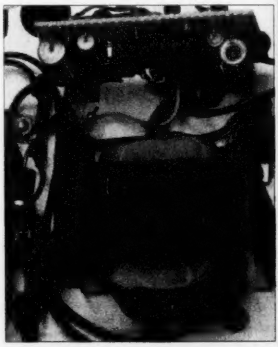


Photo E. *The DC-to-AC converter circuit includes a step-up transformer, two field-effect transistors bolted to the chassis and a 2-1/2- x 1-1/2-inch perfboard with the IC and associated components.*

PROPAGATION

Jim Gray W1XU
210 E Chateau
Payson AZ 85541

The most disappointing days (VP) for DX propagation are expected to occur during the first and last two weeks of this month, particularly the 4th, 20th, 26th, and 27th, with the occasional appearance of minor to major magnetic storms in the ionosphere. Other severe geophysical upsets may also accompany these days, and an unsettled-to-active ionosphere (P) is likely as well *surrounding* these days (see calendar).

Try to use the 10-day period between the 8th and 18th to your best advantage, but always remember that propagation is where and when you find it. Forecasts made for the period between two sunspot cycles, as now, are always uncertain and subject to sudden increases in solar flux values, particularly surrounding VP days on your calendar. Stay alert and *listen*. We're overdue for some DX surprises.

10–12 meters

Generally Poor, except for occasional transequatorial propagation with F2 openings on the best days—most likely South and Central America.

15–17 meters

DX to Africa and Latin America on the Good days possible, with short-skip out to about 1,000 miles or so in the US.

20 meters

Your best band for DX openings around the world from dawn to dark, and openings to the Southern Hemisphere after dark in evening hours. You can expect excellent short-skip during the daytime to 2,500 miles or so.

30–40 meters

These bands ought to be open for DX from just before sunset to just after sunrise. Signals from the east should peak until midnight, and after midnight to other areas. Daylight short-skip of about 500 miles will be possible, and nighttime short-skip to 1,500 miles or more will be available.

80 meters

Occasional DX to various areas of the world should be possible between sunset and sunrise when QRN levels permit on Good (G) days (see calendar). Short-skip during darkness to 1,500 miles or more.

160 meters

Following the usual summertime slump, this band ought to begin to come alive again during the hours of darkness when QRN permits. Try the days marked G on the calendar for best results. DX toward the east until midnight, and to other areas afterwards until dawn. Short-skip to 1,500 miles will prevail when the band is quiet.

SEPTEMBER 1997

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F	2 F-P	3 P	4 VP	5 P	6 P-F
7 F	8 F-G	9 G	10 G	11 G	12 G	13 G
14 G	15 G	16 G	17 G-F	18 F-P	19 P	20 VP
21 P	22 P	23 P	24 P	25 P-VP	26 VP	27 VP
28 VP-P	29 P	30 P-F				

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA									15	15	15	
WEST COAST			80	80	40	40	40	20	20	20		
CENTRAL UNITED STATES TO:												
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
RUSSIA (C.I.S.)								20	20			
SOUTH AFRICA										15	15	20
WESTERN UNITED STATES TO:												
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA										15	15	
EAST COAST		80	80	40	40	40	40	20	20	20		

---

faster than the NorthScope (hundreds of bearings each second) and that Dopplers latch onto short transmissions with ease. PIN-diode-switched Doppler arrays have no moving parts and are much less conspicuous than a big beam. Dopplers are a bit easier to use in a fast-and-furious T-hunt because they have fewer controls to adjust.

Those claims are true, but a beam/CRT configuration tops Dopplers in other important respects. A high-gain antenna makes it much more sensitive, so you can hunt stations at much greater distances. With a twist of the quad's boom, it can track horizontally polarized foxes with the correct polarization, while Doppler users are always stuck with vertical antennas.

The biggest advantage of a scope is its ability to analyze multipath and multi-signal situations. It separates the directions of direct and reflected signals. On the other hand, a Doppler set must give a single bearing indication for each rotation of its array, no matter how many signal components are present. A polar plot gives a moving picture of the channel that clearly displays multiple stations. The operator can identify each one by ear from the receiver audio as the beam goes around. You'll appreciate this feature when you are jammer hunting, because it becomes easier to separate the jammer's signal from that of the station being jammed.

One more plus for the NorthScope: Multiple overlaid sweeps on the CRT will show bearings of single sideband stations and pulsed noise sources. Dopplers, on the other hand, will not, because they require carrier-type signals. They aren't designed to track emissions with large amplitude variations.

NEVER SAY DIE

Continued from page 82

supposed to be self-policing, right?

It's simple, really. All you do is make a tape of the offender offending, then make copies and send it to his neighbors with a note explaining who is on the tape, and giving his phone number so they can help us get the idiot to shut the heck up.

If you have a phone ROM it's real easy to get the names and addresses of the neighbors on his street anywhere in the country. If you're in the same area you may be able to send a tape to his employer, in-laws, and so on.

I see no possible benefit in identifying yourself, and plenty of downside. But with no sheriff to help us, vigilante justice seems called for.

Birthday Present

Yes, come to think of it, there *is* something you can get me for my 75th birthday (Sept. 3rd). Any real old-timers, who have been reading my editorials since I first started publishing, back in 1951, will confirm that this is the first time in all those years that I've asked for a birthday present. Well, I'm 75 and it's about time you got me something.

What I want is a bigger magazine. You'll benefit too because that'll give me more pages to publish articles. I think we have enough regular columns now, and most of you will agree that my editorials are already longer than they ought to be, so a bigger magazine will mean more construction articles and equipment reviews. How can you give me a bigger magazine? That's simple — all you have to do is convince one ham friend of yours to subscribe to *73*. If every reader would get one extra subscriber I believe we would soon have double the number of ads, and that would allow me to double the number of pages in the magazine.

I was just looking at a 1980 issue and it had 274 pages. That's three times our present size. I'll bet we could match that if we had double our current subscriber base.

No, Wayne doesn't get rich if we have more readers. I retired a few years ago and stopped drawing any salary, so any added revenues will go right into making the magazine bigger and better.

Please wish me a happy 75th birthday with a nice present.

WE DON'T BUILD THE MOST, WE JUST BUILD THE BEST!

- Our LM-470D is now redesigned to hold 15 ft. of antennae at 70 mph!
- Tri-Ex builds the finest in crank-up, free-standing or guyed towers.
- All towers are complete with rigid concrete base mount.

CALL OR WRITE FOR A FREE CATALOGUE!

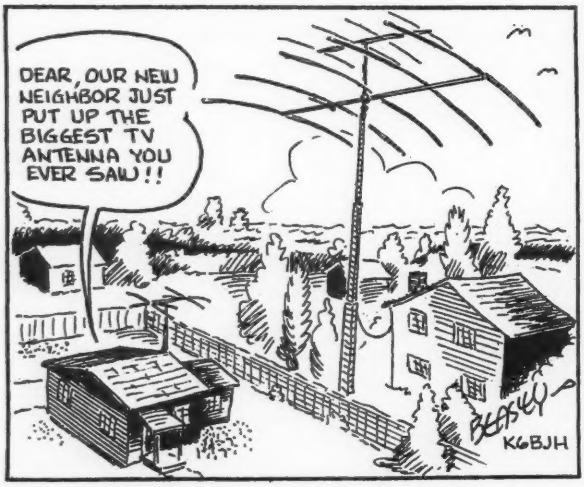
VISA MasterCard

Tri-Ex® TOWER CORPORATION
7182 Rasmussen Ave. • Visalia, CA 93291

Where engineering and quality come first!

TO ORDER CALL 800-328-2393 FAX 209-651-5157

CIRCLE 22 ON READER SERVICE CARD


DEAR, OUR NEW NEIGHBOR JUST PUT UP THE BIGGEST TV ANTENNA YOU EVER SAW!!
BEASLEY
K6BJH

Radio Bookshop
ORDER FORM

You may order by mail, telephone, or fax. All payments are to be in US funds. Allow 4 weeks for delivery.
(Prices subject to change without notice if suppliers increase prices or new editions cost us more.)

ITEM	TITLE	QTY	PRICE	TOTAL

Shipping: All orders add $5.00 handling *plus there is an additional at cost shipping charge added to all foreign orders. We ship UPS where possible, please give us street address.

S&H* ______
TOTAL $ ______

Make checks payable to "Radio Bookshop."

Foreign Orders: Choose one ☐ surface shipping ☐ air shipping
(Surface delivery may take 2-3 months.)
*Note: The actual foreign shipping costs will be additional to the regular shipping and handling fees.

Name ______ Phone ______
Address ______
City ______ State ___ Zip ___ Country ______

$10 minimum for credit card orders

Total Paid $ ☐Check/Money Order ☐AMEX ☐MC ☐VISA
Card # ______ Expires ______
Signature ______ Date ______

Telephone: 603-924-0058, 800-274-7373, FAX 603-924-8613
Mail: Radio Bookshop, Dept. 997, 70 Route 202 N, Peterborough NH 03458

☐ YES, Send me 12 issues of 73 at the low rate of $24.97 (save 47% over the cover price). Canada add $7 plus $1.40 GST; Foreign add $19 surface; $42 airmail.

JRC

JST-245

160-10 Meters PLUS 6 Meter Transceiver

NEW
JRC
14.25000
JST-245 TRANSCEIVER

Fifteen reasons why your next HF transceiver should be a JST-245. . .

1 All-Mode Operation (SSB,CW,AM,AFSK,FM) on all HF amateur bands and 6 meters. JST-145, same as JST-245 but without 6 meters and built-in antenna tuner.

★ JST-145 COMING SOON ★

2 MOSFET POWER AMPLIFIER • Final PA utilizes RF MOSFETs to achieve low distortion and high durability. Rated output is 10 to 150 watts on all bands including 6 meters.

3 AUTOMATIC ANTENNA TUNER • Auto tuner included as standard equipment. Tuner settings are automatically stored in memory for fast QSY.

4 MULTIPLE ANTENNA SELECTION • Three antenna connections are user selectable from front panel. Antenna selection can be stored in memory.

5 GENERAL COVERAGE RECEIVER • 100 kHz-30 MHz, plus 48-54 MHz receiver. Electronically tuned front-end filtering, quad-FET mixer and quadruple conversion system (triple conversion for FM) results in excellent dynamic range (>100dB) and 3rd order ICP of +20dBm.

6 IF BANDWIDTH FLEXIBILITY • Standard 2.4 kHz filter can be narrowed continuously to 800 Hz with variable Bandwidth Control (BWC). Narrow SSB and CW filters for 2nd and 3rd IF optional.

7 QRM SUPPRESSION • Other interference rejection features include Passband Shift (PBS), dual noise blanker, 3-step RF attenuation, IF notch filter, selectable AGC and all-mode squelch.

8 NOTCH TRACKING • Once tuned, the IF notch filter will track the offending heterodyne (±10 Khz) if the VFO frequency is changed.

9 DDS PHASE LOCK LOOP SYSTEM • A single-crystal Direct Digital Synthesis system is utilized for very low phase noise.

10 CW FEATURES • Full break-in operation, variable CW pitch. built in electronic keyer up to 60 wpm.

11 DUAL VFOs • Two separate VFOs for split-frequency operation. Memory registers store most recent VFO frequency, mode, bandwidth and other important parameters for each band.

12 200 MEMORIES • Memory capacity of 200 channels, each of which store frequency, mode, AGC and bandwidth.

13 COMPUTER INTERFACE • Built-in RS-232C interface for advanced computer applications.

14 ERGONOMIC LAYOUT • Front panel features easy to read color LCD display and thoughtful placement of controls for ease of operation.

15 HEAVY-DUTY POWER SUPPLY • Built-in switching power supply with "silent" cooling system designed for continuous transmission at maximim output.

JRC *Japan Radio Co., Ltd.*

430 Park Ave., 2nd Floor New York, NY 10022 Phone: (212) 355-1180 Fax: (212) 319-5227

CIRCLE 159 ON READER SERVICE CARD

Connect to the world !!

A full range of cellular antennas is available: hole mount, magnetic mount, on-glass and base station.

SKA 900 1/4
SKA 900
SKA 901 C
MICROCELL MAG
SGM 900

SIRIO antenne

46049 VOLTA MANTOVANA - MN - ITALY - Tel. (39) 376/801515 - Fax (39) 376/801254

NORTH AMERICA OFFICE: TORONTO - CANADA - TEL. (519) 650 9277 - Fax (519) 650 1779